Lessons for China from a Comparison of Logistics in the U.S. and China

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ABSTRACT

Logistics efficiency is low in China. In 2008, total logistics costs accounted for 18.1% of gross domestic product (GDP) in China, which was almost twice that of the United States. Increasing logistics efficiency can save an enormous amount of money, hence is worthy of study.

Since the U.S. is similar to China in many areas and its logistics efficiency is high, I study the U.S. and compare with China, then draw lessons from the comparison. Five aspects of logistics in both countries are analyzed: 1) logistics history, 2) transportation infrastructure, 3) logistics structure, 4) logistics IS/IT, and 5) logistics governance.

Lessons from the comparison conclude: 1) railways should receive a higher priority for infrastructure investment, 2) logistics market is too fragmented, consolidation among logistics operators should be encouraged, and 3PL market needs government support to grow, 3) IS/IT application in logistics is still in its infancy stage. Standardization of IS/IT in logistics and public information platform should be supported, and 4) logistics governance plays an important role in eliminating local government protectionism and easing imbalance between inland and coastal regions in China.

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This thesis is dedicated to my brother Wei, and to my parents who offered me unconditional love and support throughout my life.

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ABBREVIATIONS

3PL = Third-Party Logistics

4PL = Fourth-Party Logistics

BMI = Business Monitor International

CFLP = China Federation of Logistics & Production

COSCO = China Ocean Shipping Company

CRM = Customer Relationship Management

CSCMP = Council of Supply Chain Management Professionals

CTL = Center for Transportation & Logistics

DOT = Department of Transportation

EDI = Electronic Data Interchange

GDP = Gross Domestic Product

GPS = Global Positioning System

ICC = Interstate Commerce Commission

IS/IT = Information System/Information Technology

JIT = Just In Time

JV = Joint Venture

LTL = Less Than Truckload

M&A = Mergers & Acquisitions

MRP = materials Requirements Planning

MRP2 = Manufacturing Resource Planning

RFID = Radio Frequency Identification

SaaS = Software as a Service

SCM = Supply Chain Management

TL = Truckload

TMS = Transportation Management System

UPS = United Parcel Service

WMS = Warehouse Management System

CHAPTER 1
INTRODUCTION

Logistics in China has been growing fast and is helping China integrate into the world since 2001 when China became a member of World Trade Organization (WTO). Logistics in China is much improved; however, efficiency is still low compared with other developed countries. The most commonly used metric to measure logistics efficiency is the ratio of logistics cost to gross domestic product (GDP). In 2008, total logistics costs accounted for 18.1% of GDP in China (Li & Fung, 2009), which was much higher than that of the United States (9.4%) (Rosalyn Wilson, 2009). Why is the logistics efficiency in China lower than in the U.S.? I try to answer this question by analyzing and comparing logistics in U.S. and China, and draw lessons from logistics in the U.S.

Logistics cost is composed of three parts: transportation cost, inventory-carrying cost, and administration cost. Evolution of the logistics cost structure in both countries is analyzed to find the differences between them. Logistics cost or efficiency is highly affected by four factors: logistics infrastructure, logistics industry structure, information system (IS) and information technology (IT), and governance. In order to draw lessons from logistics in the U.S., these four factors are analyzed and compared.

Logistics infrastructure includes transportation infrastructure, transportation vehicles, and warehousing. Transportation infrastructure includes: rail, road, pipeline, air, water, logistics parks, etc. Transportation vehicles include motor carriers, rail, etc. The transportation infrastructure in both countries is analyzed.

In terms of logistics structure, logistics cost by composition and transportation mode is important and is analyzed. Meanwhile, logistics can also be divided into in-house and for-hire

operations. Third-Party Logistics (3PL) and Fourth-Party Logistics (4PL) are the most important sectors in for-hire operations. 3PL is compared for both countries.

Information Systems is the means to manage data, information and knowledge which are important to logistics. Companies can utilize IS to achieve competitive advantages. IT provides the technological tools for developing IS, for collecting and analyzing data in order to generate useful information which can be shared with logistics partners. How IS/IT have been adopted by both countries is studied. Moreover, problems with IS/IT application in logistics in China are analyzed and potential solutions are recommended.

Governance is the last important factor that is analyzed. Governance is composed of formal rules, regulations and informal norms that guide all partners in the logistics industry. Governance can have huge effects on the development of logistics, for example, the deregulation in 1980s in the U.S. had profound effects on its logistics development.

Logistics in the U.S. and China is analyzed in Chapter 2 and Chapter 3, a comparison of logistics in the two countries is made in Chapter 4.

CHAPTER 2
U.S. LOGISTICS REVIEW

Logistics is defined by the Council of Supply Chain Management Professionals (CSCMP) as: "The process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods, including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements."

2.1. U.S. Logistics Development History

James F. Robeson (1994) divided the evolution of U.S. Logistics into three phases:

- Functional management (1960s-1970s)
- Internal integration (1980s)
- External integration (1990s-now)

2.1.1. Functional management (1960s-1970s)

Prior to 1960, most companies separately managed their processes like purchasing, warehousing, order processing, demand forecasting, and inventory control. In 1956, a study of the economics of air freight by Howard T. Lewis, et al (1956) introduced the concept of total cost analysis. In 1961 Edward Smykay, Donald Bowersox, and Frank Mossman wrote one of the first textbooks about logistics management. Logistics was explained from a companywide view and total cost concept was discussed in that book. Douglas M. Lambert (1993) pointed out that the Council of Supply Chain Management Professionals (formerly the National Council of Physical Distribution Management) was formed in 1963 "to develop the theory and understanding of the [logistics] process, promote the art and science of managing [logistics] system and to foster professional dialogue and development in the field, operating exclusively

without profit and in cooperation with other organizations and institutions." Since then, a lot of textbooks, journals, and conferences were devoted to logistics management. There is no doubt that academia had a positive contribution to the development of logistics in business. From the early 1960s, most companies began to make a slow transition from the earlier separate management of individual processes to the integrated management of related functions which were subcategories of materials management and physical distribution. Harold E. Fearon (1973) stated that materials management is "single-manager organization concept embracing the planning, organizing, motivating, and controlling of all those activities and personnel principally concerned with the flow of materials into an organization." H.J., Bullen (1965) took physical distribution as "the broad range of activities concerned with efficient movement of finished products from the end of the production line to the consumers."

Computers were used to raise the efficiency of materials management and physical distribution. For example, Materials Requirements Planning (MRP) software had been a popular and efficient approach to materials management. The key driving forces for the change in 1970s were the high operating costs, and high fuel costs due to the OPEC oil embargo.

2.1.2. Internal integration (1980s)

As the logistics industry developed, "integrated logistics" emerged as the term to link pre-production activities and distribution function. Graham Sharman (1984) defined integrated logistics as the "total range of activities concerned with the movement of materials, including information and control systems; logistics constitutes a strand running through all the traditional functional responsibilities-from raw materials procurement to product delivery." James F. Roberson (1994) showed a 1981 A. T. Kearney study as an example to demonstrate the transition

from functional integration (1960s-1980s) to internal integration (1980s). The study divided the transition into three stages:

- "Stage One: Management views its mission as controlling finished goods transportation and warehousing. Management has an operational orientation.
- Stage Two: Management's mission is to integrate finished goods distribution and control inbound transportation. The orientation here is managerial, where individual activities are planned and controlled as parts of a total physical distribution process. The manager seeks out opportunities to improve by balancing the trade-offs.
- Stage Three: Management's mission is to integrate the total logistics process as part of the total corporate endeavor. Management's orientation turns to strategic issues like evaluating basic changes in the company's logistics/operation strategy and pursuing opportunities presented by changes to the external environment."

Companies continued to move to the stage three, or "integrated logistics", throughout the 1980s. In order to adapt to this trend, the National Council of Physical Distribution Management changed its name to the Council of Logistics Management in 1985.

There are four key driving forces for logistics evolving into internal integration in the 1980s. 1) Deregulation of transportation industry. The Airline Deregulation Acts of 1977 and 1978, Staggers Rail Act of 1980, Motor Carrier Act of 1980, and Shipping Act of 1984 removed constraints on transportation industry and changed the relationship between carriers and shippers. The deregulation had profound effects on the logistics industry and is discussed in Chapter 2. 2) Third-Party Logistics (3PL) providers. Carriers previously focused on transportation and warehousing, expanded their business to other logistics activities as the deregulation increased

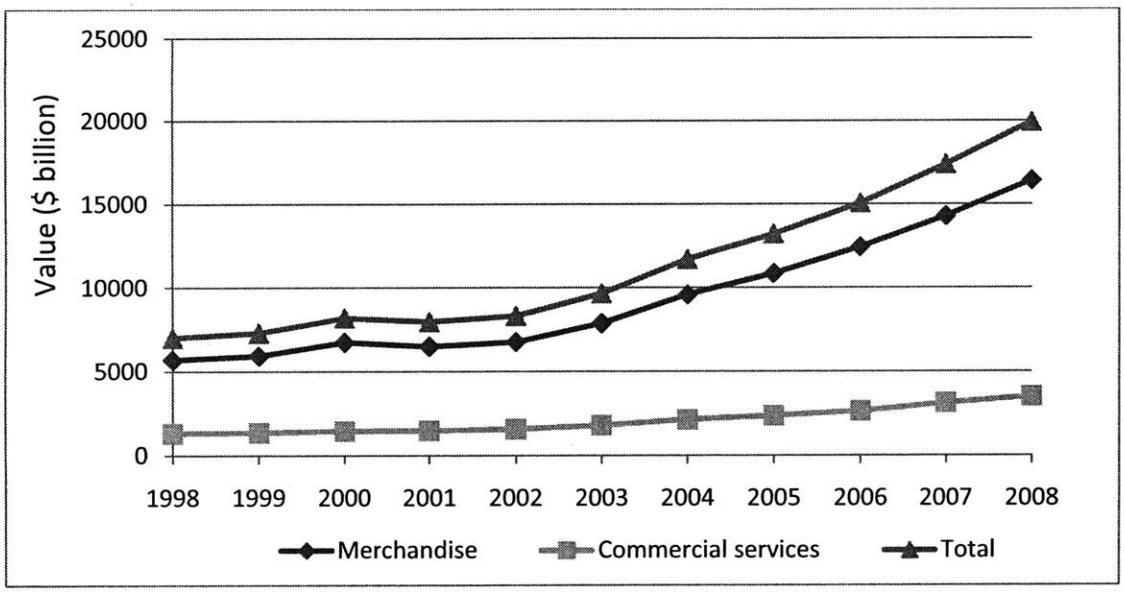
competition which led to better and integrated service from shippers. These contract logistics companies are called 3PL providers. Because 3PL providers are specialized in logistics operations, they are more efficient in logistics activities. Many companies began to outsource their logistics to 3PL providers to reduce costs and to focus on their core competencies. 3) Information Technology (IT). IT became an increasingly important component for the logistics industry. For example, electronic data interchange (EDI) was widely used to accelerate distributions. 4) Just-in-time (JIT). JIT emerged at Toyota Motor Company in Japan in order to reduce the working-in-process inventory and associated carrying cost. It was brought to the U.S. and adopted by many companies because the high logistics integration and IT were available in the 1980s. In order to successfully apply JIT, a company not only has to build a good internal integration in logistics activities but also has to ensure a good relationship with its suppliers and other partners. JIT encourages a firm to share information and extend internal integration to external integration.

2.1.3. External integration (1990s-now)

In the early 1990s, companies began to extend the internal integration of their logistics activities beyond their own companies to all the companies in the value-added chain management. The concept of logistics evolved to that of supply chain. Supply chain is defined by CSCMP as "1) starting with unprocessed raw materials and ending with the final customer using the finished goods; the supply chain links many companies together. 2) material and informational interchanges in the logistical process stretching from acquisition of raw materials to delivery of finished products to the end user. All vendors, service providers and customers are links in the supply chain." Supply chain management (SCM) has become a competitive advantage. The classic competition model of company vs. company is changing to supply chain

vs. supply chain. There are three key driving forces that propel companies toward external integration: 1) Cost reduction. Channel members can share more information such as manufacturing planning from a manufacturing firm and marketing information from retailers. The members can conduct their individual businesses more accurately and accordingly reduce their costs. 2) Risk reduction. Channel members can reduce an individual company's risk by spreading their investment and optimizing their operations. For example, a firm can negotiate with other members to reduce its inventory by utilizing other members' surplus warehousing spaces. 3) Leveraging resources. Channel members can leverage each other's resources. A company can take advantage of its retailers who have access to new markets. A company can also speed up its product development by simultaneously developing with its chain members.

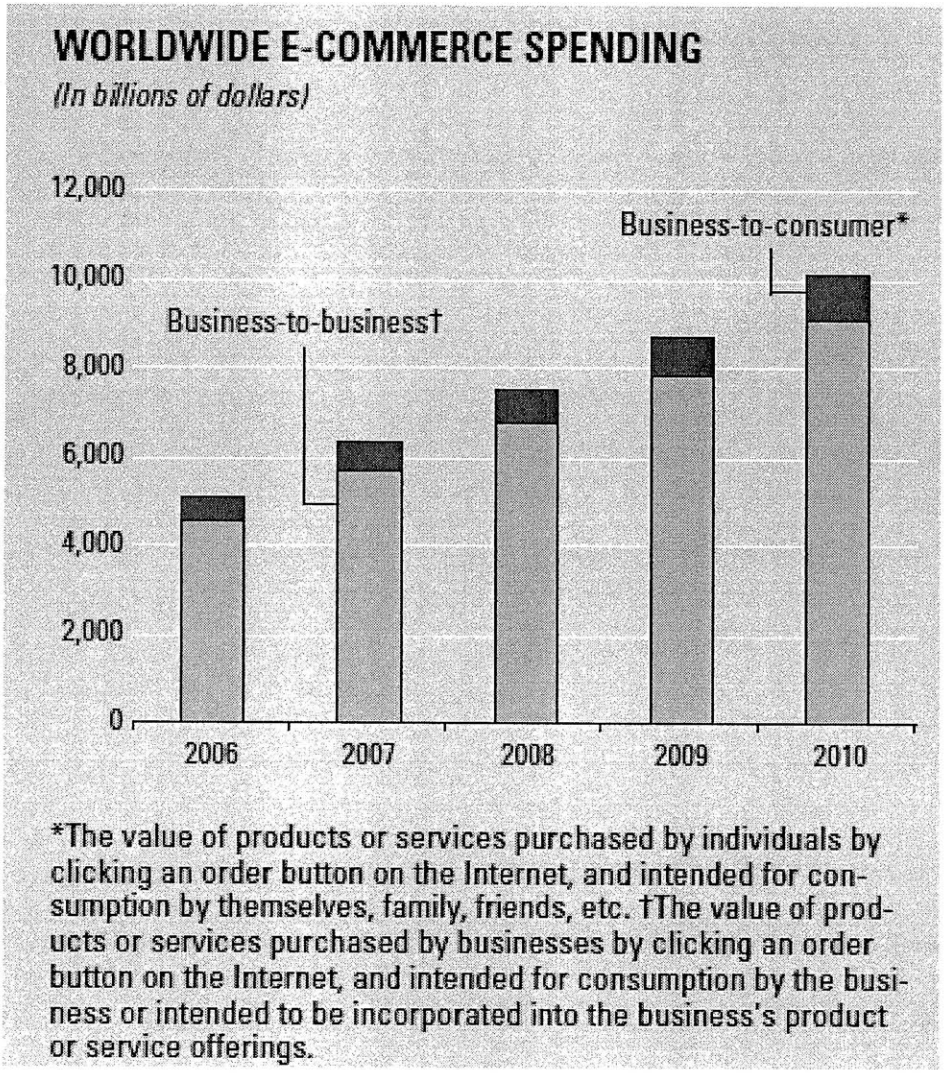
The key forces that are shaping the logistics industry are globalization and e-business. Since 1990s, many companies in developed countries have increasingly outsourced their production facilities to developing countries for low cost production. Meanwhile, many companies have expanded their market size through globalization. In 2008, about $16 trillion of merchandise, of which $3 trillion were for commercial services, were traded in the world (see **Figure 2.1**) (WTO, 2008).



Source: World Trade Organization (WTO) database (2008)

Figure 2.1 Value of Global Trade

E-business is another key force shaping the logistics industry. E-business has grown briskly since late 1990s and has become an important portion of business. In 2006, worldwide e-commerce spending was over $5 trillion (see **Figure 2.2**) (Standard & Poor's, 2008). Internet enables all the supply chain members to be connected and be more integrated. The instant information from demand and inventory raises the supply chain efficiency. On the other hand, it also challenges the total supply chain to fulfill the need of decreasing delivery time.



Source: Standard & Poor's industry survey (2008)

Figure 2.2 Worldwide E-commerce Spending

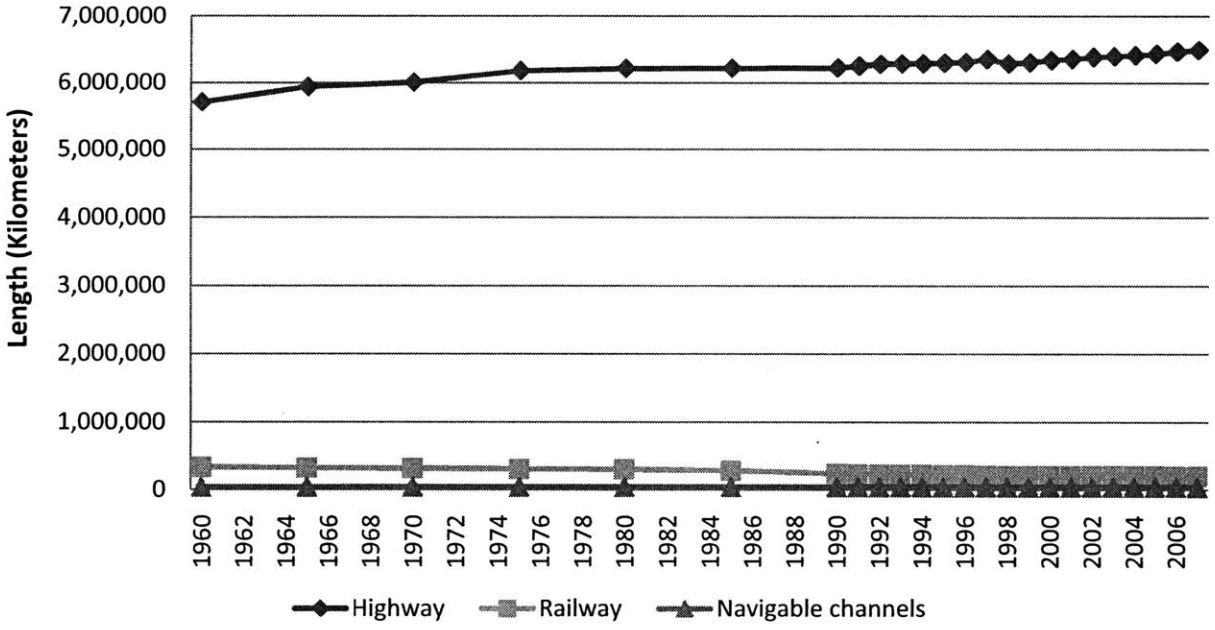
2.2. U.S. Transportation Infrastructure

Logistics infrastructure can be divided into three different sectors: transportation infrastructure (namely highway, rail, water and air transport), warehousing, and telecommunication. Because of time constraints, this thesis focuses only on transportation infrastructure. Current developments, constraints and challenges, and future developments of transportation infrastructure are discussed.

2.2.1. Current Developments

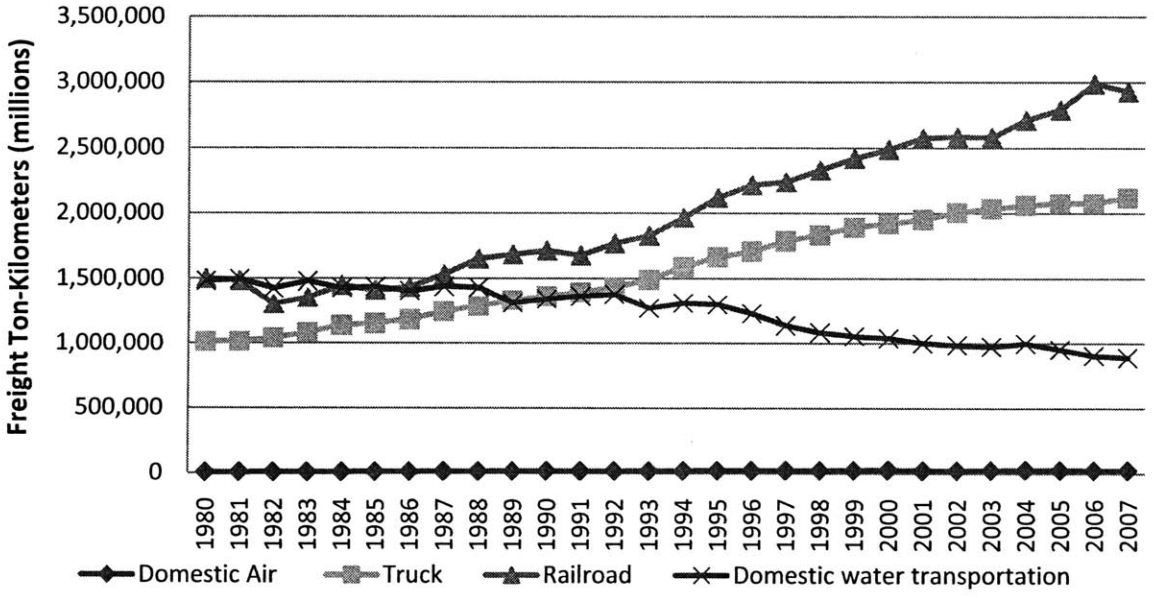
The U.S. has the largest highway and railway network in the world. It has 6.5 million kilometers of highway, with 4.2 million kilometers (65%), of it paved. It has a 203,142 kilometer railway, most of which is used for freight. There has been little change in the transportation infrastructure since the 1960s (see **Figure 2.3**). Transportation by water has remained almost the same, the highway increased by 14%, from 5.7 million kilometers in 1960 to 6.5 million kilometers in 2007, while the railway network decreased by 40%, from 333,672 kilometers in 1960 to 203,142 kilometers in 2007.

Thanks to its economic development, the U.S. has had a profound increase in freight volume (see **Figure 2.4**). The U.S.'s ton-kilometers of freight by domestic air, highway, and railroad have increased from 7.7 billion, 1013 billion, and 1500 billion ton-kilometers respectively in 1980 to 24.3 billion, 2200 billion, and 2980 billion ton-kilometers in 2007, an increase of 213%, 109%, and 95% respectively, except that freight by domestic water-borne transportation decreased from 1483 billion to 890 billion ton-kilometers, a decrease of 40%. The railroad is the dominant transportation mode for freight, carrying about half of total freight volume. The highway is the second dominant, with 36% of total freight volume (see **Figure 2.5**).



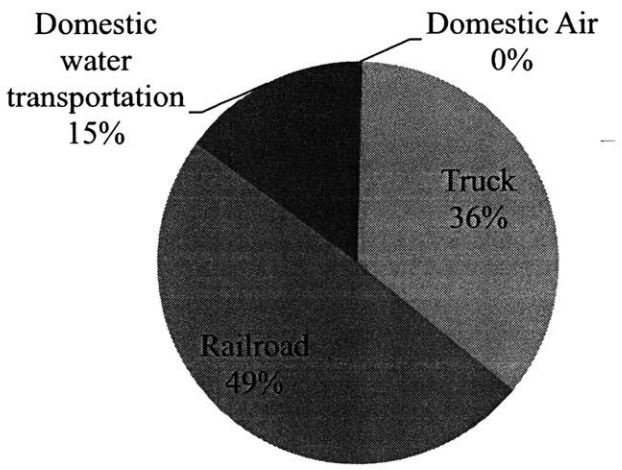
Source: Bureau of Transportation Statistics (2009)

Figure 2.3 Transportation System Length within the United States (1960-2007)



Source: Bureau of Transportation Statistics (2009)

Figure 2.4 U.S. Freight Volume Ton-Kilometers (1980-2007)



Source: Bureau of Transportation Statistics (2009), Note: the sea and pipeline transportation are not included.

Figure 2.5 U.S. Freight Volume Breakdown in 2007

2.2.2. Constraints and Challenges

The transportation infrastructure is becoming a bottleneck for the economic development of the U.S., because the freight volume is growing fast along with globalization while there has been no large investment in infrastructure since the early 1990s. According to the United States Infrastructure Report (Business Monitor International, 2009), the infrastructure in the U.S. is "poor". The report points out that more than 25% of bridges in the U.S. are dysfunctional in structure and more than $200 billion is needed until 2035 to adjust to the expected growth in rail transportation. Moreover, there is a shortage of $116 billion per year in spending on highways.

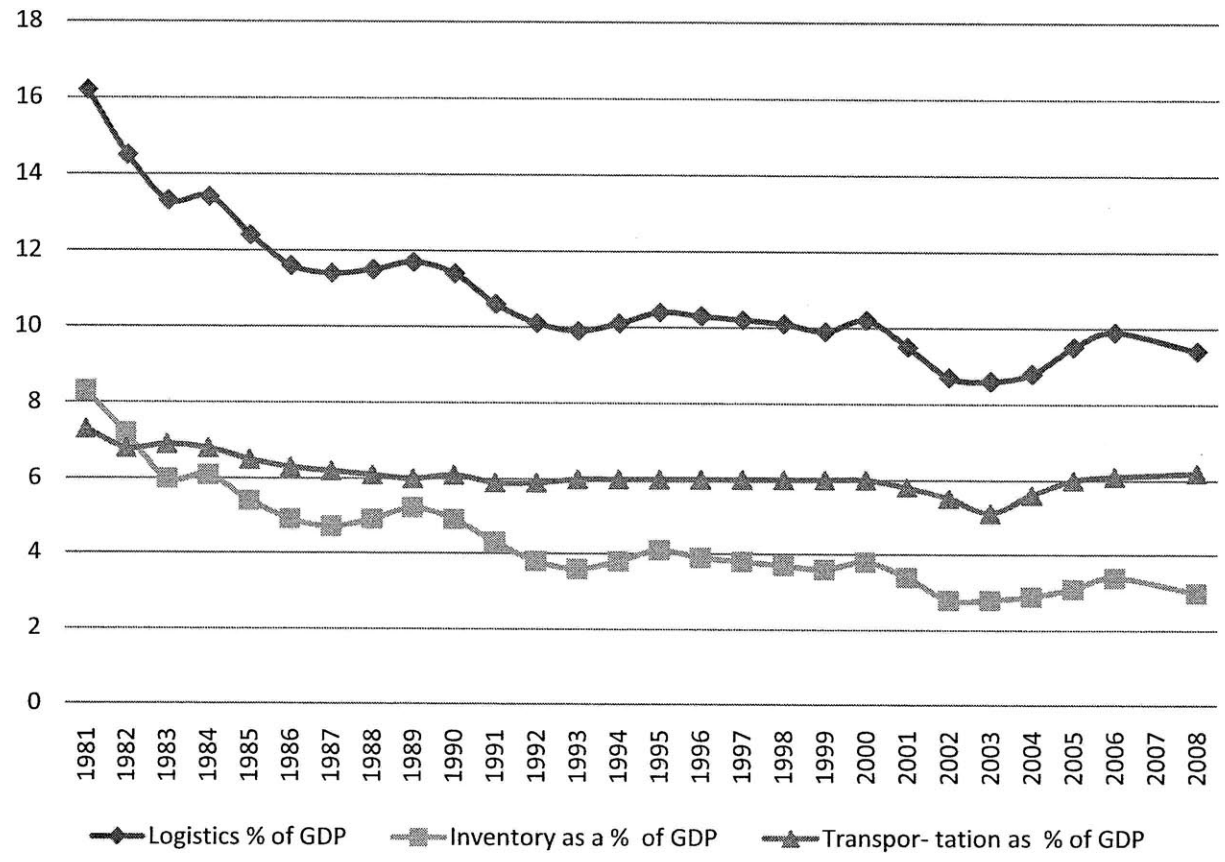
2.2.3. Future Developments

According to the United States Infrastructure Report, of the $787 billion stimulus package, $ 27.5 billion, $ 8 billion, $1.3 billon, and $ 1.1 billion is going to be spent on highway and bridge construction, high-speed railway, Amtrak, and airports respectively.

2.3. U.S. Logistics Structure

2.3.1. Logistics Costs by Composition and Transportation Mode

According to the 20th Annual State of Logistics Report, business logistics costs in the U.S. in 2008 are $ 1.975 trillion, which is 9.4% of GDP. The logistics costs to GDP ratio had decreased in the 80s', from 16.2% in 1981 to 10.1% in 1992, then has remained at a stable level (see **Figure 2.6**, see **Appendix 1** for detailed data).



Source: CSCMP's 12th, 17th, 18th, and 20th Annual State of Logistics Report

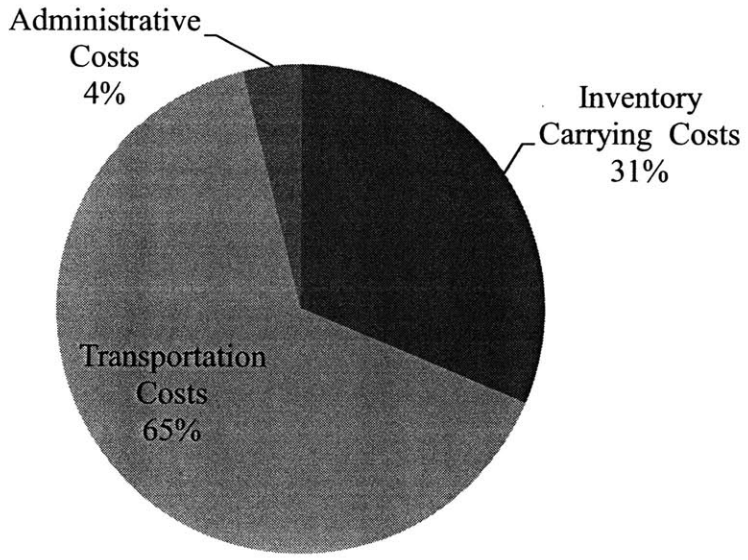
Figure 2.6 U.S. Logistics Costs as a Percentage of GDP 1981-2008

The largest portion of logistics costs is transportation costs, $ 872 billion in 2008, accounting for 65% of total business logistics costs. The second largest part is inventory carrying costs, $ 420 billion in 2008, which is 31% of total business logistics costs. The rest is for administrative costs, which is set as 4% of the sum of the transportation costs and inventory carrying costs (see **Table 2.1, Figure 2.7**). The transportation costs to GDP ratio is about 6%, and has been very stable since 1980s. The inventory carrying costs has decreased in the 1980s and 1990s from 8.3% in 1981 to about 3% in early 2000 (see **Figure 2.6**).

Table 2.1 U.S. Business Logistics Costs in 2008

Carrying costs $1.975 trillion		**$ billion**	**%**
Interest		47	3
Taxes, Obsolescence, Depreciation, Insurance		252	19
Warehousing		122	9
	Subtotal	420	31
Transportation costs			
Motor carriers			
Truck - Intercity		460	34
Truck - Local		220	16
	Subtotal	680	51
Other Carriers:			
Railroads		63	5
Water (International 32 Domestic 5)		39	3
Oil Pipelines		10	1
Air(International 15 Domestic 23)		40	3
Forwarders		32	2
	Subtotal	184	14
Shipper-related costs		8	1
Logistics administration		52	4
Total logistics costs		**1344**	**100**

Source: CSCMP's 20th Annual State of Logistics Report (2009)

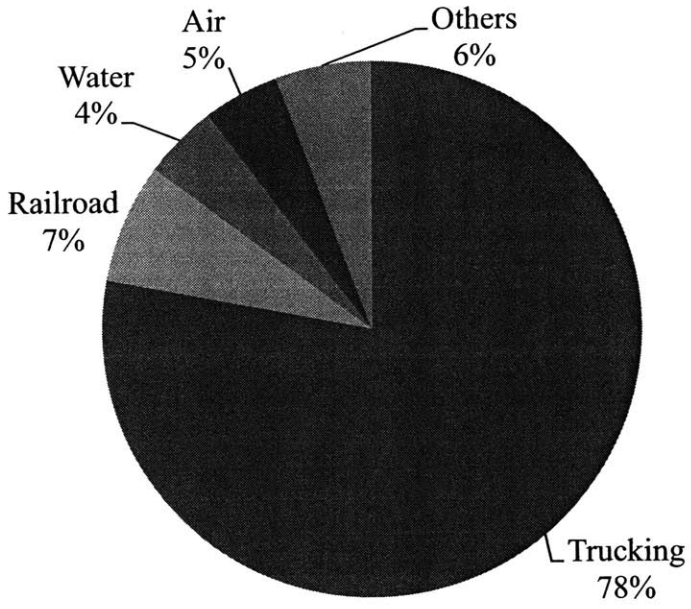


Source: CSCMP's 20th Annual State of Logistics Report

Figure 2.7 U.S. Logistics Costs Composition, 2008

Among transportation costs, trucking, railroad, air, and water comprise 78%, 7%, 5%, and 4% in 2008 respectively (see **Figure 2.8**), which is sharply discordant with their share in freight volume ton-kilometers. This is mostly attibuted to the type of transported products. The products transported by truck tend to be high-value items compared to those by trains.

According to another industry report by Standard & Poor's (2009), the U.S. business freight transportation market was $795 billion in 2008. The report stated that the trucking business is $660 billion, among which the private carriage market is estimated by American Trucking Associations to be about $ 288 billion. The for-hire operations generated about $ 372 billion in 2008, of which truckload (TL) companies generated $ 320 and the rest came from Less-than-truckload (LTL).

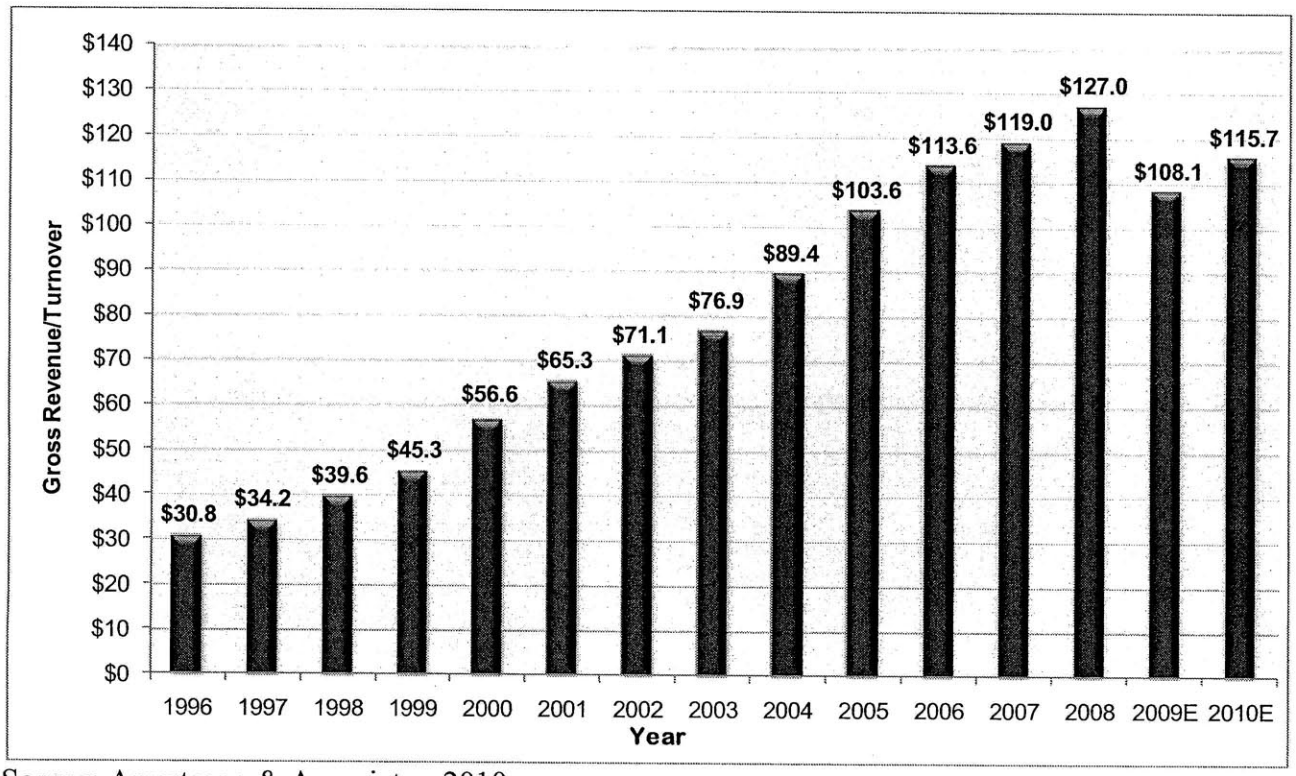


Source: CSCMP's 20th Annual State of Logistics Report

Figure 2.8 U.S. Transportation Logistics Costs by Mode, 2008

2.3.2. Third-Party Logistics (3PL)

The legal definition of a 3PL is "A person who solely receives, holds, or otherwise transports a consumer product in the ordinary course of business but who does not take title to the product." 3PL has been rapidly growing at a compound annual growth rate of 12.5% from 1996 to 2008 (see **Figure 2.9**). The gross revenue of 3PL increased from $ 30.8 billion in 1996 to a historically high $ 127 billion, namely 9.5% of the total logistics costs, in 2008. The gross revenue of 3PL is expected to decrease in 2009 due to the financial crisis, but is expected to recover from 2010.



Source: Armstrong & Associates, 2010

Figure 2.9 U.S. 3PL Market 1996 – 2010E (US$ Billions)

Armstrong & Associates (2005) segments the 3PL sector into four groups, as shown in **Table 2.2.** The largest segment in terms of gross revenue is international transportation management. The second largest one is domestic transportation management. These two sectors are mostly non-asset logistics service. The dedicated contract carriage sector provides motor carriers, drivers and management to clients so that they do not need to operate their own fleet and can concentrate their energy on core competencies. Value-added warehousing and distribution sector provides long-term contract warehousing and/or distribution center with value-added services to their clients.

Table 2.2 U.S. 3PL 2009 Revenue Declines from 2008 (US$ Billions)

3PL Segment	2009E Gross Revenue	2009E Net Revenue
Domestic Transportation Management	32.0	5.7
International Transportation Management	34.4	15.6
Dedicated Contract Carriage	9.5	9.4
Value-Added Warehousing & Distribution	29.2	23.9
Total*	$ 105.1	$ 54.6

* Total 2009E gross revenue (turnover) for the 3PL market in the U.S. is estimated at $108.1 billion. $3 billion is included for the contract logistics software segment.
Source: Armstrong & Associates, 2010

2.4. U.S. Logistics Information System and Information Technology

IS is the means to manage data, information and knowledge which is important to logistics. Companies can utilize IS to achieve competitive advantages. IT is taken as a technological tool for developing IS, collecting and analyzing data in order to generate useful information which can be shared with logistics partners.

The development and applications of IS/IT in supply chain management can be divided into four levels (Donald Waters, 2007):

- Level one: Transaction support IS/IT

  IS/IT is used in transaction support system. Database management system is the key technique for IS. In terms of IT, bar-coding and scanner technology is the main technology to collect transaction data and convert them into information by point-of-sale system and then produce receipts for customers. At this level, IS/IT is not integrated into other departments, it may not align with the interests of the total organization.

- Level two: integrated organizational IS/IT

IS/IT is used to manage information in the logistics operations in organizations where all functions are integrated. This is an intranet system. Enterprise resources planning (ERP) is the most widely used intranet system.

- Level three: information sharing and exchange IS/IT

  IS/IT is used to exchange and share information between companies at this level. The system is also called extranet system. Electronic data interchange (EDI) and collaborative planning, forecasting and replenishment (CPFR) are the most used extranet systems.

- Level four: internet-based SCM systems

  The internet has changed the world and is playing an increasingly important role in society. Internet enables all the supply chain members to be connected and integrated. As Walters mentioned, the most distinguishing feature of the internet-based SCM system is that "it changes the information exchange from one to one, to one to many, and many to many" simultaneously.

Walters continued to explain "the differences between intranet, extranet and internet lie in who is allowed to access and use the IS/IT. An intranet is authorized only to internal members in an organization to use; an extranet system is specified for those users who perform predefined logistics activities and transactions among two or more organizations; and internet systems allow unlimited users to access and use the system functions available and facilitate SCM information sharing."

Today many companies take IS/IT at a strategic level of importance and heavily invest in it. The most sophisticated intermodal IS/IT is being used by the integrated carriers such as United Parcel Service (UPS) which spends more than $ 1 billion each year for IT/IS.

As internet is indispensable for most companies, it is becoming more and more important for them. E-marketing, e-business, e-logistics or e-supply chain management are becoming popular. Software-as-a-service (SaaS) is being adopted in multiple enterprise markets, such as customer relationship management (CRM), transportation management systems (TMS), warehouse management system (WMS) and procurement. SaaS is defined by Gartner (2009) as "software that's owned, delivered and managed remotely by one or more providers." Compared with traditional software such as SAP and Oracle, SaaS has a lower cost. SaaS also has a significantly lower start-up cost and very low requirements for internal IT staff support. Salesforce.com is the leading company in SaaS CRM. According to Gartner (2009), SaaS has increased its revenue from less than $ 500 million or 8% of the CRM market in 2005 to more than $ 1.7 billion or about 18% of the market in 2008.

2.5. U.S. Logistics Governance

The U.S. government had taken the transportation sector as a public utility, thus had sought to control the number of competitors, pricing, and services offered. The first U.S. transportation regulation, Act to Regulate Commerce, was imposed by congressional action in 1887. Many transportation regulations have been enacted for different transportation modes. In 1966, Congress established the U.S. Department of Transportation (DOT) to govern the transportation system.

Since 1977, U.S. began deregulation of transportation. Air, motor, rail and water transportation modes had been deregulated (see **Table 2.3**). The Airline Deregulation Acts of 1977 and 1978 removed almost all airline controls, except those related to safety. The acts gave air carriers more flexibility, market entry/exit, and routing choices. Motor Carrier Act of 1980

Table 2.3 Recent Federal Transportation Legislation Leading to Major Changes in Transportation Policy

Date(s)	*Event*	*significance*
Deregulation		
1977, 1978	Airline Deregulation Acts	Freed all-cargo aircraft operations from Civil Aeronautics Board (CAB) regulations. Allowed air carriers significantly greater pricing flexibility, market entry/exit, and routing. CAB restrictions were to be gradually removed and the CAB abolished on January 1, 1985.
1978	The Toto Supreme Court Decision [Toto Purchasing and Supply, Common Carrier Application 128 MCC873 (1978); Ex Parte Number MC-118	Removed backhaul restrictions from private carriers.
1980	Motor Carrier Act	Comprehensive legislation deregulating the motor carrier industry. Major provisions allowed carriers to adjust their rates within a "zone of reasonableness" without ICC approval, reduced the authority of rate bureaus, provided greater flexibility in contract carriage, opened markets to greater competition through relaxed entry restrictions, and allowed intercorporate hauling by private carriers.
1980	Staggers Rail Act	Removed much of the ICC's authority over rail rates. Established a zone of rate flexibility. Reduced the importance of rate bureaus and authorized railroad contracts with shippers.
1980	Household Goods Transportation Act	Reduced government regulation of household movers in the areas of pricing, reporting requirements, liability (e.g., insurance), and customer payment.
1984	Shipping Act	Partially deregulated the ocean transport industry. Allowed carriers to pool or apportion traffic, allot ports and regulate sailings, publish port-to-port tariffs, and enter into confidential service contracts with shippers. Allowed shippers to form nonprofit groups to obtain volume rates.
1986	Surface Freight Forwarders Deregulation Act	The federal government is more stringently enforcing safety and environmental standards.
1994	Trucking Industry regulatory Reform Act Federal Aviation Administration Authorization Act	

1995	Interstate Commerce Commission Termination Act	
1998	The Ocean Shipping Reform Act Maritime Security Program	
Reauthorization		
1978	Surface Transportation Assistance Act	First combined highway, transit, and safety into a single law. It increased highway funding flexibility.
1982	Surface Transportation Assistance Act	Created the Transit Account of the Highway Trust Fund.
1987	Surface Transportation and Uniform relocation Assistance Act	Provided 5 years of funding for the highway, transit, and safety programs with sufficient funding to complete the National System of Interstate and Defense Highways.
1991	Intermodal Surface Transportation Efficiency Act	Strengthened sated and local planning requirements, and provided unprecedented funding flexibility for state and local officials to tailor transportation investments to meet local needs.
1995	National Highway System Designation Act	Created the National Highway System and State Infrastructure Bank Pilot Program.
1996	Federal Aviation Reauthorization Act	Instituted FAA reform on cost accounting of federal aviation expenditures. It established airport privatization pilot programs.
1998	Transportation Equity Act for the 21st Century	Affirmed key priorities: improving safety, protecting public health and the environment, and creating opportunity for all U.S. citizens. It provided record levels of investment to continue rebuilding the U.S.'s highways and transit systems, doing so within a balanced budget. It expanded public participation in the planning process.
2000	Wendell Ford Aviation Investment and Reform Act for the 21st Century	It substantially increased funding for airport development both through the Airport Improvement Program and by allowing an increase in the passenger facility charge. The Act also funded the continued redevelopment of the air traffic control infrastructure, providing the most significant change in technology and procedures in fifty years. It provided airport infrastructure grants that can result in competitive access for new entrant carriers. It emphasized modernization of air traffic system management.

Source: Douglas M. Lambert (1994), Kenneth J. Button (2005)

deregulated motor carriers, eliminated most restrictions previously placed on motor carriers. The Staggers Rail Act of 1980 deregulated rail carriers. In 1984, the Shipping Act partially deregulated the ocean transport industry. Deregulation has had profound effects on the transportation industry. Since deregulation, the number of the Interstate Commerce Commission (ICC) regulated motor carriers had increased from 18,000 in 1980 to 40,000 in 1989 (Burnley). More new entrants led to a higher level of competition and put more pressure on motor carriers to be cost-efficient and drove the inefficient competitors out of the industry. For instance, in the LTL market, half of the largest motor carriers had become bankrupt by 1988 (see **Table 2.4**), some LTL carriers had merged with other carriers during the same period.

The transportation policy-making in the U.S. is complex. The decision-making process involves a wide range of government bodies at the federal, state and local levels, and citizen's and community groups, private sector and individuals (Kenneth J. Button, 2005). Because their interests and needs are different, an integrated package of policy has to be made for implementation.

2.6. Conclusion

Logistics development in the U.S. can be divided into three stages: functional management (1960s-1970s), internal integration (1980s), and external integration (1990s-now).

The U.S. has advanced transportation infrastructure, with the longest highway and railway network in the world. However, the transportation infrastructure is in a poor condition because of insufficient investments since early 1990s.

The ratio of logistics costs to GDP had continuously decreased in 1980s, from 16.2% in 1981 to 10.1% in 1992, thereafter has remained at a stable level. The increasing efficiency in

Table 2.4 How the Motor Carrier Industry Has Changed Since Deregulation: Top 20 LTL Carriers, 1979 and 1988 ($ millions)

1979			*1988*	
Name	*Revenues*	*Comments*	*Name*	*Revenues*
1. Roadway Express	$1,098		1. Yellow Freight System	$1,992
2. Consolidated Freightways	849		2. Consolidated Freightways	1,749
3. Yellow Freight System	805		3. Roadway Express	1,694
4. Ryder Truck Lines	560	Merged with P.I.E.	4. Overnite Transportation	638
5. McLean Trucking	540	Bankrupt	5. ABF System	617
6. P.I.E. Nationwide	403	Merged with Ryder	6. Carolina Freight Carriers	532
7. Spector Freight System	316	Bankrupt	7. P.I.E. Nationwide*	500
8. Smith's Transfer	253	Bankrupt	8. ANR Freight System	468
9. Transcon Lines	238		9. Preston Trucking	368
10. ETMF Freight System	235	Merged with ABF	10. Central Transport	309
11. Interstate Freight System	233	Bankrupt	11. St. Johnsbury	297
12. Overnite Transportation	229		12. Transcon Lines*	266
13. ABF System	229	Merged with ETMF	13. Central Freight Lines	211
14. American Freight System	223	Bankrupt	14. Viking	205
15. Carolina Freight Carriers	216		15. TNT Holland	182
16. Halls Motor Transit	199	Bankrupt	16. NW Transportation	172
17. Masson & Dixon Lines	184	Bankrupt	17. Watkins	172
18. Lee Way Motor Freight	172	Bankrupt	18. Churchill	140
19. T.I.M.E. D.C	170	Bankrupt	19. A.P.A	129
20. Wilson Freight	165	Bankrupt	20. TNT Red Star Express	127

*Declared bankruptcy in 1990
Source: James Aaron Cooke (1990)

logistics mainly contributed to the improvement in inventory management due to extensive IS/IT application. In addition, 3PL in the U.S. had experience a continuous growth at a compound average growth rate of 12.5% from 1996 to 2008. The gross revenue of 3PL in 2008 was $ 127 billion, about 9.5% of the total logistics costs.

IS/IT is highly developed and utilized by logistics operators in the U.S. Many companies take IS/IT as a core competency and invest a enormous amount of money for sustainable growth.

Logistics governance in the U.S. has huge effects on logistics industry. For instance, deregulations in the 1970s and 80s had stimulated the logistics development.

CHAPTER 3
CHINA LOGISTICS REVIEW

3.1. China Logistics Development History

China started its reform and open policy in 1978. Since then, the country has been transforming itself from a centrally planned economy to a market economy. China has experienced fast growth with an average 10 percent growth in GDP and 18 percent in trade from 1980 to 2009. By the end of 2009, China was the third largest economy in terms of GDP, following the United States, and Japan. China has also become the largest exporter. The fast growing economy and trade provide the momentum for its logistics industry.

The concept of 'logistics' was imported into China in the 1990s. Since then, logistics in China has witnessed a huge growth along with its fast growing economy. Logistics in China has accelerated since China's entry to the WTO in November 2001. Prior to China's entry, foreign logistics participations were regulated in most logistics sectors. Chinese logistics industry had been divided into sub-sectors where logistics activities were strictly regulated. After entry to the WTO, China has committed to a deadline to open its logistics markets (see **Table 3.1**). Many foreign logistics companies have established joint ventures with domestic logistics companies in the first several years of China's accession to the WTO and gradually changed their status to wholly foreign-owned companies. For instance, the world's four largest courier service providers, DHL, FedEx, UPS, and TNT chose Sinotrans, which is the largest Chinese logistics company, as their Joint Venture (JV) partner in 1986, 1986, 1996, and 1988 respectively. While by 2005, UPS, TNT and FedEx all terminated their JV's with Sinotrans, by the end of 2006, UPS became a fully-owned company in China through the buyout of its JV Sinotrans's customers.

Table 3.1 Post-WTO Accession Regulations in China

	By 2002	By 2003	By 2004	By 2005	By 2006	By 2007
Shipping and freight forwarding	–	Majority ownership by foreign firms	–	–	Wholly owned subsidiaries. No limit on foreign firms to international freight business	
Maritime cargo handling, customs clearance	–	Majority	–	–	–	–
Rail transport	Foreign–PRC joint venture permitted	–	Majority ownership	–	–	Wholly owned subsidiaries
Road transport	Minority ownerships/ joint ventures	Majority ownership	–	Wholly owned subsidiaries	–	–
Warehousing and storage	Minority ownerships/ joint ventures	Majority ownership	–	Wholly owned subsidiaries	–	–
Courier	Minority ownerships/ joint ventures	Majority ownership	–	–	Wholly owned subsidiaries	–

Source: Accenture (2002)

Logistics operators in China originated from five different backgrounds (Donald Waters, 2007). The first group came from former subsidiaries of relevant ministries, for instance, Sinotrans came from the Ministry of Foreign Trade. The second group is made up of the foreign logistics companies such as DHL. They have a reputation and a huge capital advantage. Meanwhile, they are also in an advantageous position due to favorable regulations towards foreign investors. The third group comes from the logistics department of some large conglomerates extending their logistics operations to other companies in their related industry. Haier Logistics, which had been set up through integrated Haier's logistics functions, has now grown to a 3PL logistics company providing services to the parent Haier Group and other producers of consumer electronics as well. The fourth group was from the original transportation companies such as China Railway Container Transport Co and they extended their service vertically. The last group consists of private companies which are usually small, but important and fast growing.

Logistics efficiency in China is still much lower than that of developed countries. In 2008, the total logistics costs accounted for 18.1% of GDP in China (Li & Fung, 2009), which was much higher than that of the United States (9.4%) (Rosalyn Wilson, 2009). In order for China to increase its logistics efficiency, it has to overcome many challenges such as protectionism from local governments, the low-integrated national transport network, and the still small size of domestic 3PLs. The logistics infrastructure still suffers from bottlenecks and needs continuous investment in order to be built to keep pace with the fast growing economy. There are also many other challenges to develop modern logistics in China such as the huge geographical imbalance (see **Table 3.2**). The imbalance between coastal provinces and inland is actually becoming more serious.

Table 3.2 China: International Trade by Origin/Destination in China

	1998 US$'000	1999 US$'000	2000 US$'000	2001 US$'000	2002 US$'000	2003 US$'000	2004 US$'000
National total	324,033,642	360,649,443	474,308,185	509,768,127	620,768,077	851,207,294	1,154,791,620
Coastal provinces	287,290,620	321,688,892	430,176,402	463,222,811	567,871,428	778,312,733	1,069,529,407
Inland	36,743,022	38,960,551	44,131,783	46,545,316	52,896,649	72,894,561	85,262,213
Proportion	%	%	%	%	%	%	%
Coastal	88.7	89.2	90.7	90.9	91.5	91.4	92.6
Inland	11.3	10.8	9.3	9.1	8.5	8.6	7.4

Source: China Customs, 1998-2004

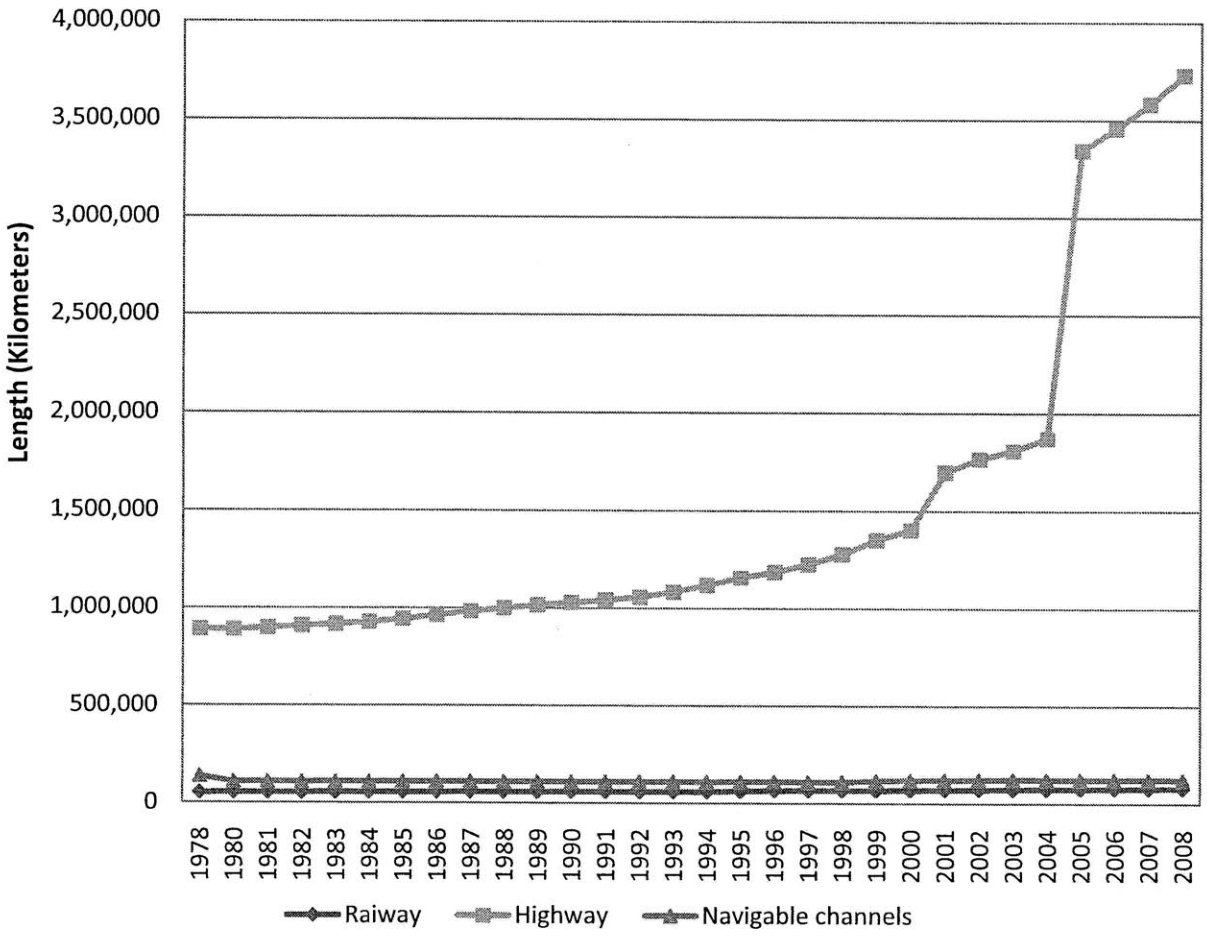
The trade by destination gap between coastal provinces and inland has increased from 77.4% in 1998 to 85.2% in 2004.

In order to support the logistics industry development in China, China's State Council issued the program "Restructuring and Rejuvenation Program of Logistics Industry" in March 2009 (see **Appendix 2**). The program is expected to have huge effects on the logistics industry during the years 2009 to 2011.

3.2. China Transportation Infrastructure

3.2.1. Current Developments

Logistics infrastructure is important for the development of China's economy since its economy is export-oriented. Highway, railway, waterway and air transportation are the most important transportation modes. The highway functions as the backbone of China's transportation system. Railway and waterway are vital in high-volume freight traffic as they have cost advantages. China has the world's second longest highway network, after the United States. The total length of highway was 3.73 million kilometers by the end of 2008 (see **Figure 3.1**).

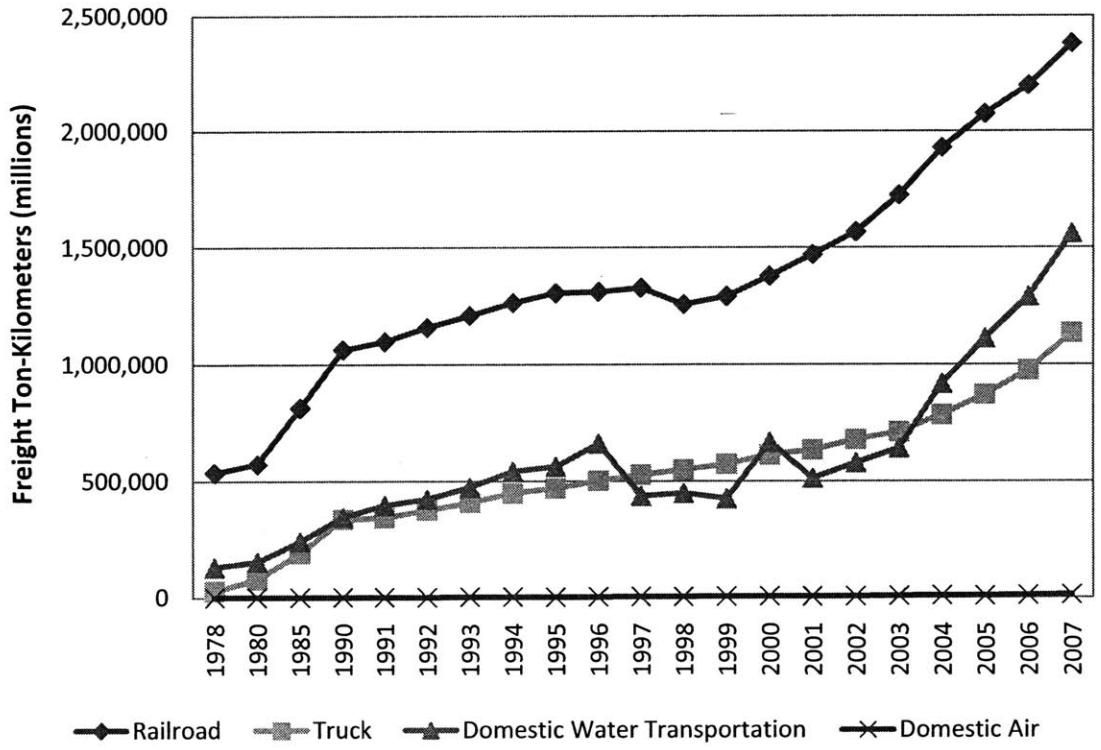


Source: National Bureau of Statistics of China. Note: From 2005, rural highway has been added into the total highway.

Figure 3.1Transportation System Length within China (1978-2008)

Of the total highway length, express highway is 60,300 kilometers. The total length of railway is 797,000 km and the navigable channel 1.23 million km, by the end of 2008.

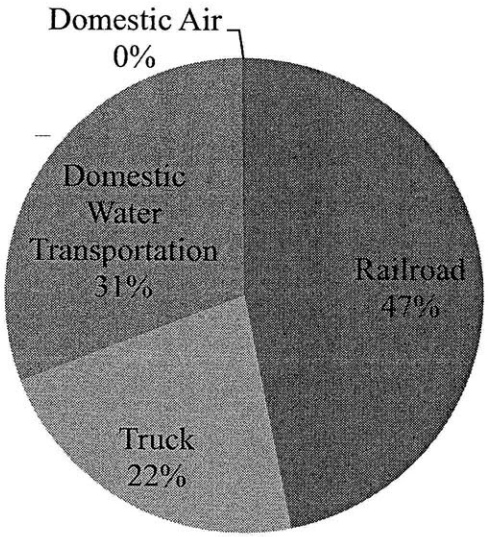
China has had a dramatic increase in its freight volume (see **Figure 3.2**). The ton-kilometers of freight by domestic air, highway, railroad, and domestic water transportation had increased from 1 billion, 274 billion, 534 billion, and 129 billion ton-kilometers in 1978 to 116 billion, 1135 billion, 2380 billion, and 1560 billion ton-kilometers respectively in 2007, i.e., increased 120, 41, 4.5, and 12 folds respectively. The railroad is the dominant transportation



Source: National Bureau of Statistics of China

Figure 3.2 China Freight Volume Ton-kilometers (1978-2007)

mode for freight, with about half of total freight volume. Domestic water transportation is the second dominant one, with 31% of total freight volume. With a much longer transport length, the highway ranks as only the third transportation mode for freight, with 22% of total freight volume (see Figure 3.3). The discrepancy in transportation length and freight volume is due to much difference in average transport length. Most freight transported by highway is short haul with an average transport length of 69 km, which is much shorter compared to the average length by railway of 757 km in 2007.



Source: National Bureau of Statistics of China

Figure 3.3 China Freight Volume Breakdown in 2007

3.2.2. Constraints and Challenges

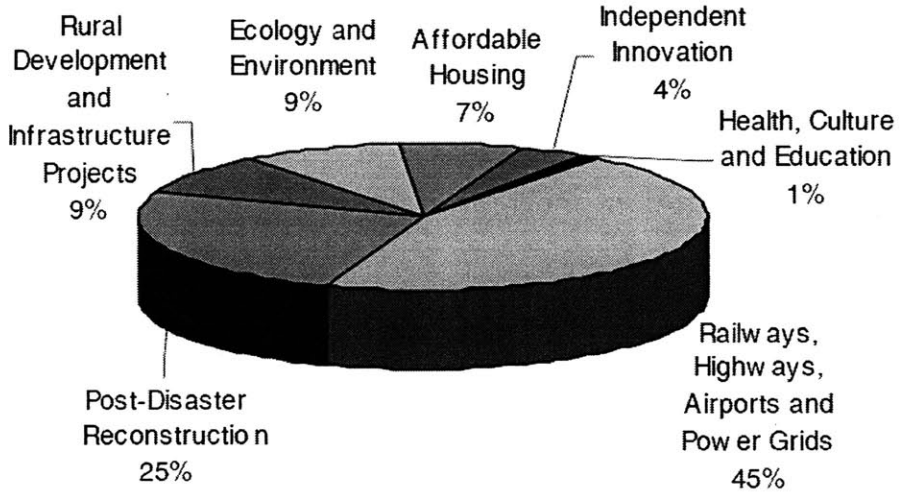
Despite the rapid increase of transportation length, the rate of increase in length is generally slower than that of freight volume. This problem is especially serious with respect to railways. The proportion of the length in formal operation is almost in its full capacity (higher than 92%) since 2005 (NBS, 2008). According to a paper (Mark Goh, 2003), Ministry of Railway pointed out that over 50% of freight had to change to other transportation modes such as highway in 2000.

Low integration of the national transport network is also a challenge. For instance, inland cities and the gateway port cities are linked mainly by railway. But by 2005, railway provided less than 1% of container throughputs at major Chinese ports (Donald Waters, 2007). It is difficult to upgrade the railway for container adoption since double-decker trains are not feasible for most parts of China due to its mountainous characteristics. Waters pointed out that highways

have become the backbone of land containerization. The economic distance of trucking divides China into container-accessible coastal regions and the rest of China.

3.2.3. Future Developments

Transportation infrastructure in China is struggling to keep up with the fast growing economy. According to a report by Business Monitor International (BMI, 2009), China has pledged to invest $ 68 billion for several announced major projects in transportation infrastructure since 2008, including a portion from the stimulus plan. On November 9, 2008, China announced its RMB 4 trillion ($ 586 billion) stimulus package, a key portion of which is spending on infrastructure and in particular, railways (see **Figure 3.4**).



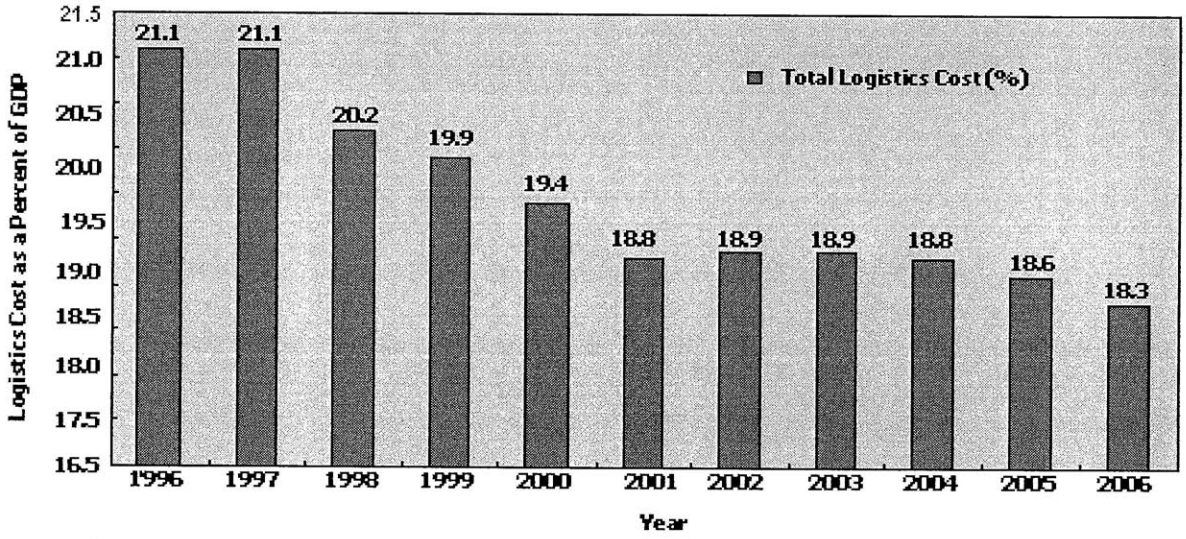
Source: Business Monitor International

Figure 3.4 Breakdown of Stimulus (%) in China

3.3. China Logistics Structure

3.3.1. Logistics Costs by Composition and Transportation Mode

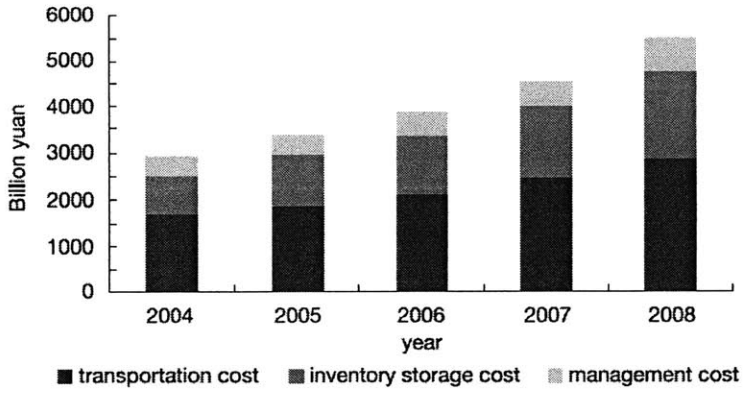
In 2008, the total logistics cost was RMB 5454 billion (about $ 802 billion), accounting for 18.1% of GDP in China (Li & Fung, 2009). According a white paper (Frost & Sullivan, 2007), the total logistics costs as a percent of GDP has been slowly decreasing from 21.1% in 1997 to 18.3% in 2006 (see **Figure 3.5**).



Source: Frost & Sullivan

Figure 3.5 Logistics Cost as a Percentage of GDP (China), 1996-2006

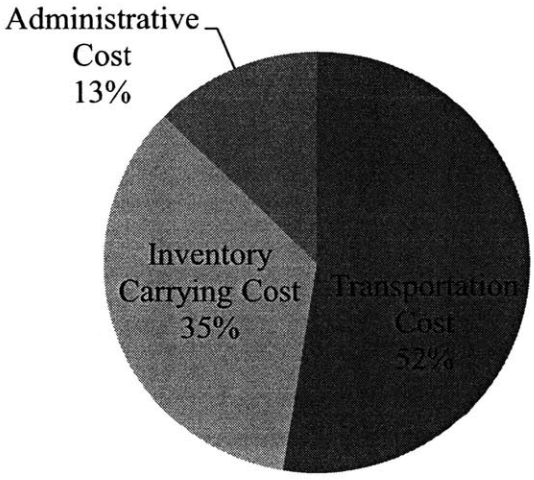
The largest part of logistics costs is transportation costs, about 50 to 60 percent and has been constantly declining since 2004 (Li & Fung, 2009, see **Figure 3.6, Figure 3.7**). Administrative cost also has been decreasing slightly since 2004. On the contrary, inventory carrying cost has been constantly climbing from 29.1 per cent in 2004 to 34.7 per cent in 2008.



	Share in the total logistics cost				
	2004	2005	2006	2007	2008
Transportation	56.9%	55.1%	54.7%	54.4%	52.6%
Inventory storage	29.1%	31.4%	32.1%	32.9%	34.7%
Management	14.0%	13.6%	13.2%	12.7%	12.7%

Source: Li & Fung Research Centre

Figure 3.6 Total Logistics Cost and its Composition, 2004-2008

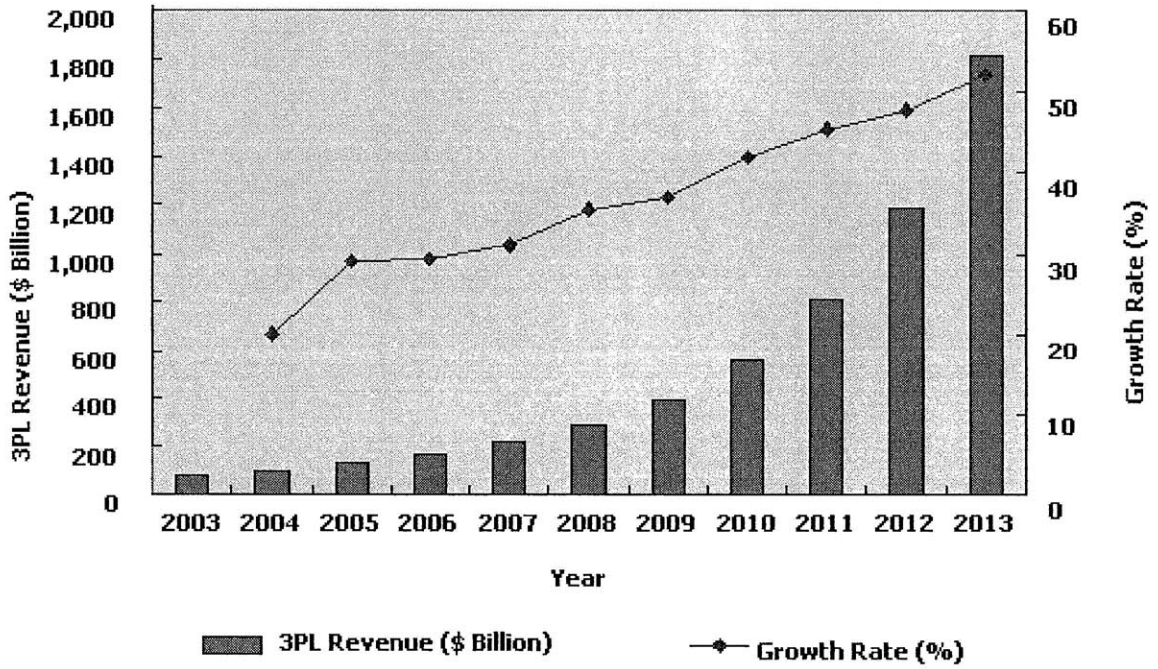


Source: Li & Fung Research Centre

Figure 3.7 China logistics costs composition in 2008

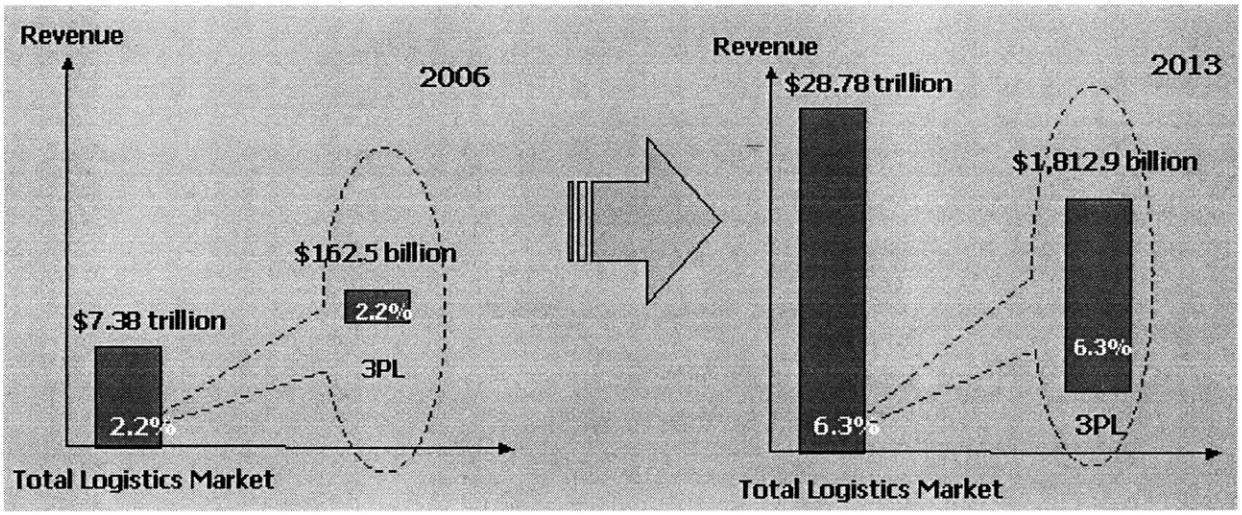
3.3.2. Third-Party Logistics (3PL)

The 3PL is still a small player in China's logistics industry. According to Frost & Sullivan's report, 3PL services contributed only about 2.2 percent of the total logistics revenue in 2006. 3PL is in its early development stages in China and is experiencing a high growth in revenue (see **Figure 3.8**). The growth of the 3PL market is driven by Chinese high-growth economy and the open market to international competition since China's accession to WTO. The 3PL market size (based on cargo value) is expected to grow from $ 162.5 billion, namely 2.2 percent of total logistics market in 2006, to $ 1,813 billion or 6.3 percent of total logistics market in 2013 (see **Figure 3.9**).



Source: Frost & Sullivan, 2007. Note: The base year is 2006.

Figure 3.8 Total 3PL Revenue and Forecasts in China (Based on Cargo Value), 2003-2013

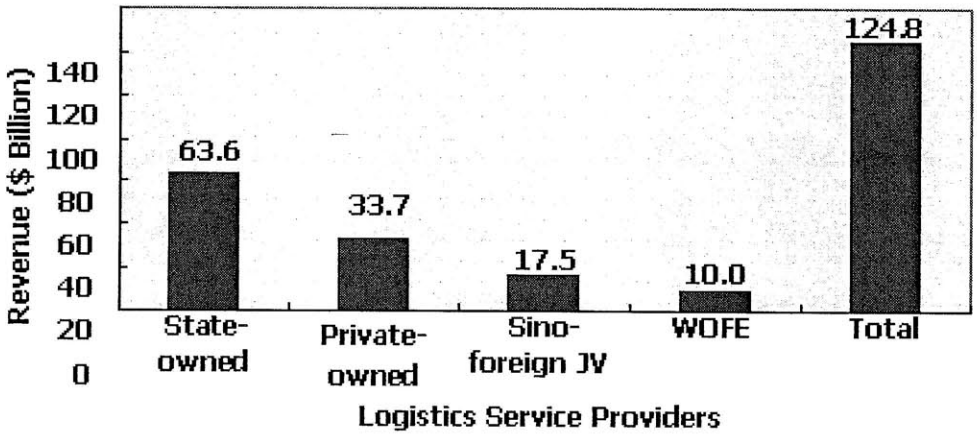


Source: Frost & Sullivan, 2007. Note: The base year is 2006.

Figure 3.9 Total 3PL Market Size in China, 2006 and 2013

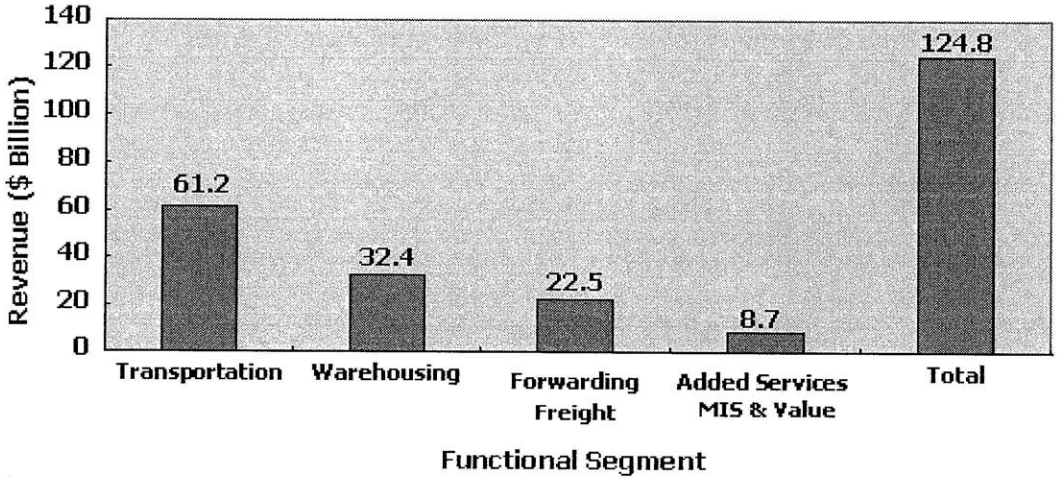
The 3PL market in China was highly fragmented in 2006. Even the biggest 3PL player has less than 2 percent share of the total market (Frost & Sullivan, 2007). Foreign 3PL firms have been struggling in setting up their business due to the complicated and time-consuming nature of building up a nationwide network. The wholly-owned foreign enterprises (WOFE) logistics firms had only 10 percent, and Sino-foreign JV had 17.5 percent of the 3PL market in 2006. The state-owned firms dominated the market, with 63.6 percent of the market share (see **Figure 3.10**).

Transportation and warehousing are still the main services that 3PL player can provide in China. Transportation and warehousing account for 49 percent and 26 percent of the total 3PL market in 2006. Freight forwarding service contributed 18 percent and Management information system (MIS) and value-added services accounted for only about 7 percent of the total 3PL market in 2006 (see **Figure 3.11**).



Source: Frost & Sullivan, 2007. Note: The base year is 2006.

Figure 3.10 Breakup of 3PL Revenue by Logistics Service Providers in China in 2006



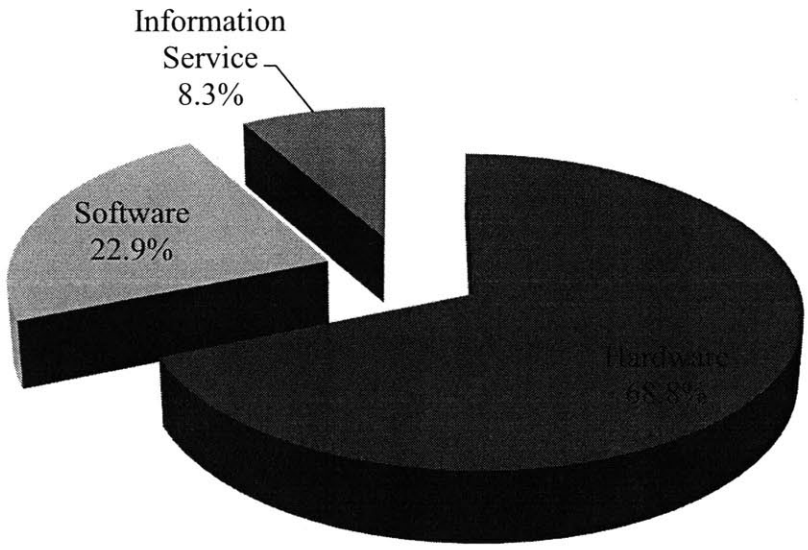
Source: Frost & Sullivan, 2007. Note: The base year is 2006.

Figure 3.11 Total 3PL Market Size by Functional Segment in China in 2006

3.4. China Logistics Information System and Information Technology

In China, the IS/IT application market in the logistics industry is still a small market, with RMB 3.32 billion (about $ 490 million) in 2006 (CCID Consulting, 2007). Hardware investment dominates the IT application market, with 68.8 percent market share of the total market in 2006

(see **Figure 3.12**). Software investment captured 22.9 percent in 2006 and has been experiencing faster growth than hardware as logistics firms have recognized its importance; information service has been overlooked and in many cases taken as a subsidiary of hardware and software. Most of the Chinese logistics companies are still in the early stages of building their IT capability. Hardware investment is the main characteristic of this stage. As those companies move to later stages, software and information services are expected to grow faster and capture a larger portion of the total IT application market in logistics in China.



Source: CCIDConsulting, 2007

Figure 3.12 IT Application Market (by Revenue) in China Logistics Industry in 2006

There are many problems constraining the IS/IT development in the logistics industry in China. Lack of logistics specialists, low level of demand of IS/IT applications from domestic firms, and lack of IS/IT standardization are the three main constraints.

First, China is seriously short of logistics specialists as the modern logistics industry has a short history in China. The government predicted that the shortage of logistics specialists is about 400,000 in 2010. Haoxiang Ren, Vice President of China Society of Logistics, said that even in the most developed area such as Shanghai and Beijing, logistics employees with college degrees is only 21% and 19% respectively. While in the U.S., 92% of logistics managers have college degrees.

Second, most of the domestic firms need only a basic demand of IS/IT applications such as Manufacturing Resources Planning (MRP2). Few firms invest or plan to invest in advanced IS/IT application such as ERP. High costs of implementation of IS/IT is part of the reason why they have been reluctant to invest.

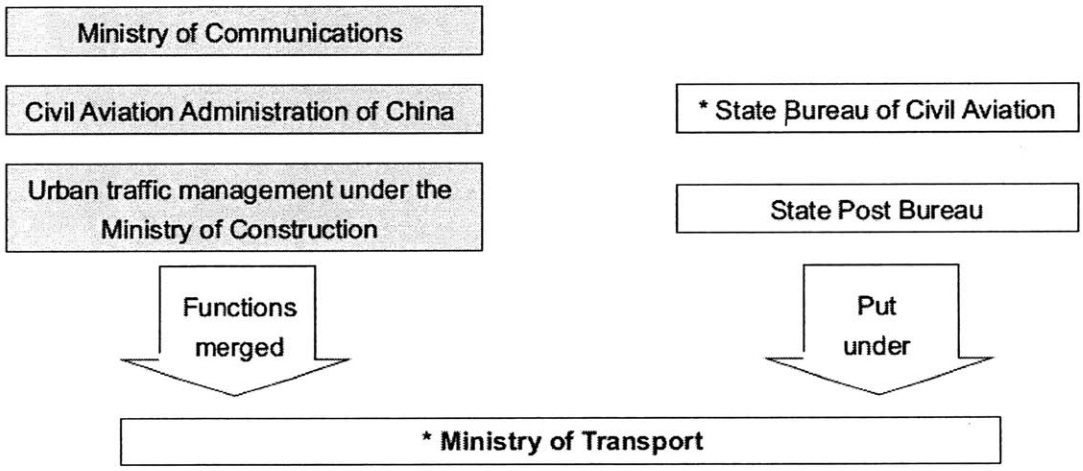
Lastly, lack of IS/IT standardization is also a problem. Each industry demand of IS/IT application is different and this leads to different standards. For instance, the retail industry has a high demand for information integration. Along with globalization, IS/IT standardization in China has been building up, and the constraints are diminishing.

3.5. China Logistics Governance

The logistics environment in China has dramatically improved since China's accession to WTO in 2001. Foreign logistics operators have been allowed to participate in almost all aspects of China's logistics market. On August 5, 2004, the Ministry of Commerce released a communiqué: 'Notice on promoting the development of China's modern logistics'. The communiqué covers policies to standardize registration, simplify administration and taxation, and promote the opening up of the logistics market. In March 2008, the Ministry of Transport was set up in order to increase logistics administrative efficiency and cooperation among

different departments. The Ministry of Transport consolidates various government departments in terms of communications, civil aviation, urban traffic, and postal services (see **Figure 3.13**).

Even though it has achieved huge improvement in logistics governance, the Chinese government still faces many challenges. The major one is local protectionism. Local governments have their own interests in generating GDP within their own jurisdictions. They have no incentives to improve the total efficiency which logistics companies care about most. Thus, this causes some inefficiencies and sometimes waste, such as duplicated investment in infrastructure. In addition, according to China's licensing regulations, companies have to obtain a separate business license for each province where they operate. This protectionism has been impeding logistics development in China.



* *Newly established*
☐*Dissolved after restructuring*
Source: Li & Fung, 2008

Figure 3.13 Ministry of Transport

In order to provide support for the logistics industry development in China, in March 2009, China's State Council issued a program "Restructuring and Rejuvenation Program of Logistics

Industry" (see **Appendix 2**). Strengthening organizations and coordination among departments and local governments are some of the supportive measures that the Chinese government is taking. As the labor cost is climbing and manufacturing industry is shifting from East to West of China, more policies are expected to be issued to improve China's logistics efficiency.

3.6. Conclusion

The concept of "logistics" was imported into China in the 1990s. Since then, logistics in China has experienced a rapid growth, and accelerated since China's access to the WTO in 2001. Despite the high growth in recent years, the logistics efficiency in China is still much lower than that of development countries. In 2008, the ratio of total logistics costs to GDP was 18.1%, which was almost twice that of the U.S. (9.4%).

Transportation infrastructure in China has experienced a high growth since 1978. However, transportation infrastructure is still the bottleneck in increasing the logistics efficiency. This problem is more serious in railway transportation. The other constraint is the low integration of the national transport network. It is expected the problem will mitigate as China began to invest more heavily in its infrastructure.

The ratio of logistics as a percentage of GDP has been slightly decreased in last decade. The decreasing ratio has contributed to the improvement in transportation. Contrary to the pattern of logistics in the U.S., the ratio of the inventory management to GDP in China has increased in recent five years. This is mainly because logistics in two countries reside at different development stages. 3PL in China is still small, contributed only about 2.2% of the total logistics revenue in 2006. 3PL market is dominated by state-owned logistics operators, hold 63.6% market share in 2006.

IS/IT application market in logistics is very small. The market is dominated by hardware investments, with 68.8% market share of the total market in 2006. Lack of logistics specialists, low level of IS/IT applications from domestic companies, and lack of IS/IT standardization are the three main problems constrain IS/IT development in China.

Logistics environment in China has been dramatically improved since China's entry to the WTO in 2001. Chinese government still faces many problems, for instance, local protectionism and imbalance between inland and coastal provinces have impeded the logistics development in China.

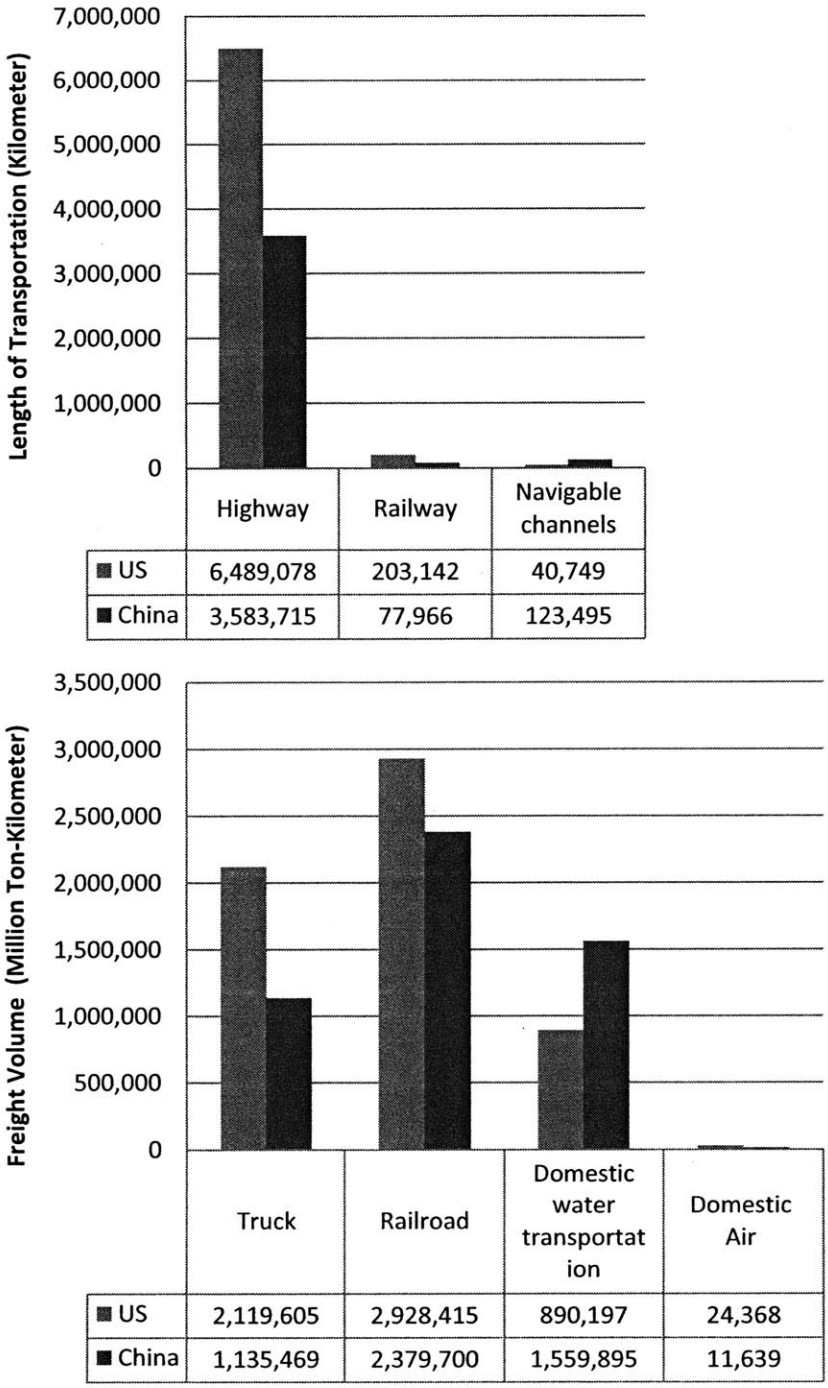
CHAPTER 4
COMPARISON OF LOGISTICS IN THE U.S. AND CHINA

4.1. Continuous Improvement in Logistics Infrastructure

China and the U.S. are almost of the same size. But China has a more advanced transportation infrastructure needs than the U.S. The length of highway in the U.S. is almost twice that of China. The Length of railways in the U.S. is more than twice that of China. Only in terms of navigable channels does China have a longer network than that of the U.S. Freight volume and length of transportation have a similar pattern (see **Figure 4.1**). Freight volume by truck in the U.S. is almost twice that of China. But in terms of freight volume by railroad, the two countries have a similar number. The reason is that the railroad in China has been operated to its limit and it has become a bottleneck in China's attempt to raise its logistics efficiency.

China should invest more on railroads. According to NBS, China has invested RMB407 billion in railways, RMB741 billion in highways, and RMB120 billion in water transportation in 2008 respectively. Railway transportation is greener than highway and more economical with respect to high volume and long distance transportation. Transportation by railway is even more important in China than in the U.S. because it is the best choice to reduce the imbalance between East and West of China given that trucks have their economic distance in transportation.

China should not only invest in building a longer railroad, but also invest in building facilities to utilize the railroad transport mode. By 2005, railway provided less than 1 percent of container throughputs at major Chinese ports, which was much lower than the U.S., with the number at about 20 percent.



Source: Bureau of Transportation Statistics (2009), National Bureau of Statistics of China

Figure 4.1 Comparison of Length of Transportation and Freight between the U.S. and China (2007)

4.2. Optimization of Logistics Structure

In the U.S., the decreasing ratio of logistics costs as a percentage of GDP has contributed to the increasing efficiency in inventory management. The ratio of transportation costs to GDP is about 6%, and has been very stable since the 1980s while the inventory carrying costs had decreased in the 1980s and 1990s from 8.3% in 1981 to about 3% in early 2000 (see **Figure 2.6**).

On the contrary, in China the decreasing ratio of logistics costs as a percentage of GDP has mainly contributed to the increasing efficiency of transportation and administrative management. The carry cost however, has been constantly climbing from 29.1 percent in 2004 to 34.7 percent of the total logistic costs in 2008 (see **Figure 3.6**).

The difference in the pattern of change of the logistics efficiency between China and the U.S. can be explained in this way. China is still in the early stages of logistics development; logistics companies have been experiencing consolidation. Those large companies with economies of scale and economies of scope have advantages in lowering transportation and administrative costs. As logistics companies grow, they will invest more on IS/IT because it is becoming the largest competitive advantage. In the near future, there should be a similar trend of the changing logistics cost composition in China as in the U.S.

The logistics market fragment in China is also very different from that of the U.S. The Chinese logistics market is too fragmented. China Ocean Shipping Company (COSCO), the largest logistics operator in China captured only 2.7 percent of the total logistics market in China in 2007. COSCO had revenue of RMB 122.6 billion in a RMB 4570 billion logistics market in China. The largest fleet in China is only about one fourth of the largest one in the world in 2009 (see **Table 4.1**).

Table 4.1 Top 20 Fleets in Operation as of 2 December 2009

Ranking	Operator	TEUs
1	APM-Maersk	2,066,675
2	Mediterranean Shg Co	1,491,587
3	CMA CGM Group	1,014,789
4	Evergreen Line	562,986
5	APL	550,384
6	Hapag-Lloyd	470,744
7	CSCL*	454,537
8	COSCO Container L.*	452,442
9	Hanjin Shipping	426,186
10	NYK	410,727
11	K Line	347,097
12	MOL	344,310
13	OOCL*	325,847
14	CSAV Group	324,811
15	Yang Ming Line	317,201
16	Hamburg Süd Group	313,986
17	Zim	279,107
18	Hyundai M.M.	271,943
19	UASC	188,259
20	PIL (Pacific Int. Line)	187,778

*Note: * Chinese operators*

Source: Li & Fung, 2009 which is based on AXS-Alphaliner

3PL is the other big difference between the U.S. and China in logistics structure. 3PL market is also highly fragmented. According to a report by Frost & Sullivan in 2007, the largest 3PL company had less than 2 percent share of the total 3PL market. Compared with the advanced global 3PL service providers, Chinese 3PL service providers are still small. Sinotrans Ltd, the largest Chinese 3PL company, with gross revenue of $ 5.74 billion, is only about one sixth of the world's largest, DHL Supply Chain & Global Forwarding in 2008 (see **Table 4.2**).

Table 4.2 Top 20 Global 3PL Service Provider

Ranking	Third-Party Logistics Provider	Gross Revenue (USD million)
1	DHL Supply Chain & Global Forwarding	37,100
2	DB Schenker Logistics	21,000
3	Kuehne + Nagel	20,087
4	Nippon Express Co. Ltd.	19,014
5	Panalpina, Inc.	9,855
6	CEVA Logistics	9,304
7	UPS Supply Chain Solutions	9,055
8	C.H. Robinson Worldwide, Inc.	8,579
9	DSV Solutions Holding A/S	7,094
10	Geodis	7,000
11	Agility	6,474
12	SDV International Logistics	5,851
13	Sinotrans Ltd.*	5,743
14	Expeditors Int'l of Washingtonne, Inc.	5,634
15	DACHSER GmbH & Co. KG	5,292
16	NYK Logistics	5,270
17	GEFCO	5,198
18	Toll Holdings Limited	4,764
19	Norbert Dentressangle Group	4,567
20	UTi Worldwide Inc.	4,544

*Note: * Chinese operators*

Source: Li & Fung, 2009 which is based on Amstrong & Associates, Inc

To optimize the logistics structure in China, the government should encourage logistics companies to integrate advanced IS/IT into their supply chain management, encourage logistics market to consolidate by mergers and acquisitions, support the 3PL service providers to grow from providing simple service such as transportation to integrated service.

4.3. Increased Investment in Logistics Information System and Information Technology

IS/IT application market in logistics in China, with RMB 3.32 billion (about $ 490 million) in 2006 (CCID Consulting, 2007), is even less than half of the spending of one U.S. company, UPS which has invested more than $ 1 billion in IT/IS each year.

As IS/IT is playing an increasingly important role in improving logistics efficiency, the government should strongly support its development. For instance, government can provide taxation and other financial support to encourage IS/IT development. Government can also encourage the consolidation of 3PL market through M&A or JV or strategic alliance. Only when 3PL operators gain high competency in logistics, would those large companies who do not believe 3PL can outperform their in-house logistics outsource their logistics business.

The Chinese government should also support the standardization of IS/IT. The elimination of different standards among different local governments can encourage logistics companies to grow their business across the whole nation. Strengthening some industry-wide organizations to hold periodic forums among logistics operators and leading the formation of standardization of IS/IT can also be helpful. In the U.S, the Council of Supply Chain Management Professionals (CSCMP) plays an important role in the total logistics activities. Recently, China also came up with similar logistics organizations namely China Federation of Logistics & Purchasing (CFLP).

One of nine initiatives in the Rejuvenating Program for Logistics Industry is building public information platforms. It is also one important way that the government can invest in IS/IT to increase logistics efficiency. Companies are encouraged to share their information and outsource the logistics operations on the platform. All carriers can utilize the platform to access logistics information much more easily and effectively from shippers, thus increasing logistics efficiency. For example, the freight empty backhaul is very high in China. Jinan Municipal

Administration of Foreign Experts Affairs pointed out that the freight empty backhaul in China is about 37% in 2005, which was much higher than that of the U.S., with almost no empty freight backhaul. Recently, many local governments and companies are building up public information platforms. For instance, in 2008, Wendeng City invested $ 1.5 million to enable its 4,000 taxis with Global Positioning System (GPS), for control of taxis through public information platform, resulting in reducing the empty backhaul rate by 20 percent and reducing operating costs.

4.4. Improvement in Logistics Governance

Logistics governance has a huge effect on logistics efficiency in almost all nations. The deregulation of transportation of 70s and 80s in the U.S. had promoted logistics development. There were many newcomers who entered the market such as FedEx, which was formed in 1971. In the meantime, the logistics industry had a consolidation process: many large companies were formed by M&A and other companies without competency had exited the market. China can learn from the effect of deregulation in the U.S. Is the deregulation of the train transportation mode in China possible? At least we know that increased competition in logistics market can lead to the emergence of some large companies through M&A or other ways.

Local government protectionism is the other problem that China's central government should eliminate through publishing and implementing policies. It is important to understand what the root causes of protectionisms are, and then, eliminate them systematically. For instance, local governments build their own logistics parks only for attracting investors and subsequently attain potentially higher GDP. The root cause is that local governors are evaluated by the GDP they can create in the territory they are governing. Changing the evaluation system can solve the problem but is not a feasible solution. How to eliminate the duplicated investment in

infrastructure and actually almost all other industries has been a serious problem for the central government.

Inland China is much less developed than coastal provinces for historical reasons. In order to diminish the imbalance between inland and coastal provinces, China started "Go-West" strategy in 2000. Logistics infrastructure is the first step that the government has taken to implement the strategy. China is still the "World's Factory", so logistics infrastructure is the prerequisite to shift the manufacturing industry inland. Logistics operators, especially those located inland should be supported in terms of tax, funding, etc.

Logistics talents training should also be covered. Compared with the U.S., China has lagged much behind. Advanced logistics needs highly qualified people who have integrated skills from operations, IT and management and are willing to cooperate with the people from marketing and strategy. One solution is to set up more logistics departments in higher education institutions and encourage cooperation between institutions and corporations. MIT is a good example. MIT launched the Center for Transportation & Logistics (CTL) in 1973, "where students, faculty, and industry leaders pool their knowledge and experience to advance supply chain education and research." CTL has 44 partners such as UPS, DHL, General Motors, etc. Students have opportunities to do real projects with those companies, thus obtain much more experience after graduation.

4.5. Encouraging Innovation

Innovation has always been the best and fastest way to catch up with the forefront of an industry. There is no exception for the logistics industry. There have been many innovations in

IS/IT and other management systems in the U.S. For instance, GPS and Radio Frequency Identification (RFID) technology have hugely changed the logistics industry.

How to get funding for 3PL to grow is a serious problem in China. Warehouse financing is an innovative way to solve the problem. Warehouse financing was elected as the No.1 in the Ten Logistics Innovations of Year 2004 (Xuepin Cen, 2005), which was very successfully taken advantage of by Chinese logistics companies. The innovative idea of warehouse financing is that goods from shippers are held in trust by 3PL for a loan from banks.

Companies have to keep track of the innovations in the logistics industry. The government should also support the research in technology with high potential, and create an innovation-savvy environment for the logistics industry.

CONCLUSION

The thesis analyzes the logistics industry both in the U.S. and China in five aspects: 1) logistics history, 2) transportation infrastructure, 3) logistics structure, 4) logistics IS/IT, and 5) logistics governance, then compares the logistics industry in both countries and draws lessons from logistics in the U.S.

The lessons drawn from logistics infrastructure are that China still lags behind the U.S. in highways and railway networks. Railway is the largest bottleneck transportation mode in China and should receive higher priority for investment. Railway is even more important when considering how to solve the imbalance between inland and coastal provinces in China because it is the most economical way in high-volume long distance freight transportation.

In terms of logistics structure, the Chinese logistics market is more fragmented than that of the U.S. In order to be competitive in China and abroad, logistics operators have to grow through M&A or strategic alliance. The 3PL market has similar problem; service providers are too small, providing simple, non-integrated solutions to shippers. Lastly, the trend in the change of logistics cost structure between the U.S. and China is different, the declining ratio of logistics cost to total GDP in the U.S. contributed to the improvement of inventory management, while in China it is caused by the improvement of transportation and administrative management. The difference can be explained by the different stages at which the country resides. It is expected that the ratio of logistics cost to total GDP will decline as China's logistics industry develops and logistics operators invest more on inventory management.

The logistics IS/IT application market in China is still much smaller than that of the U.S. It is suggested that logistics companies upgrade their services to gain from the outsourcing trends

of large companies. Standardization of IS/IT in logistics should also be supported by government policy. Public information platform should be built up to increase logistics efficiency.

Logistics governance has been playing an important role in the industry. Eliminating local government protectionism, easing the imbalance between inland and coastal regions, applying up-to-date logistics IS/IT in ports, and educating talented students in logistics management, are all important to the logistics industry development.

Admittedly, this research is at a broad, and not deep, level. To draw better lessons from comparing the logistics in the U.S. and China, more future research will be needed in each aspect which this report mentions. For instance, how IS/IT has effected logistics can be a large enough topic for research, even researching one technology such as RFID is a good thesis topic.

Apprendix 1. The Cost of the Business Logistics System in Relation to Gross Domestic Product ($ in Billions except GDP)

Table 3 - The Cost of the Business Logistics System in Relation to Gross Domestic Product ($ in Billions Except GDP)

Year	Nominal GDP $ Trillion	Values of All Business Inventory	Inventory Carrying Rate (%)	Inventory Carrying Costs	Transpor-tation Costs	Admini-strative Costs	Total U.S. Logistics Costs	Transpor-tation as % of Logistics	Logistics % of GDP	Inventory as a % of GDP	Transpor-tation as % of GDP
1981	3.13	747	34.7	259	228	19	506	45.1	16.2	8.3	7.3
1982	3.26	760	30.8	234	222	18	474	46.8	14.5	7.2	6.8
1983	3.54	758	27.9	211	243	18	472	51.5	13.3	6	6.9
1984	3.93	826	29.1	240	268	20	528	50.8	13.4	6.1	6.8
1985	4.21	847	26.8	227	274	20	521	52.6	12.4	5.4	6.5
1986	4.45	843	25.7	217	281	20	518	54.2	11.6	4.9	6.3
1987	4.74	875	25.7	225	294	21	540	54.4	11.4	4.7	6.2
1988	5.11	944	26.6	251	313	23	587	53.3	11.5	4.9	6.1
1989	5.44	1005	28.1	282	329	24	635	51.8	11.7	5.2	6
1990	5.8	1041	27.2	283	351	25	659	53.3	11.4	4.9	6.1
1991	5.99	1030	24.9	256	355	24	635	55.9	10.6	4.3	5.9
1992	6.32	1043	22.7	237	375	24	636	59	10.1	3.8	5.9
1993	6.64	1076	22.2	239	396	25	660	60	9.9	3.6	6
1994	7.05	1127	23.5	265	420	27	712	59	10.1	3.8	6
1995	7.4	1211	24.9	302	441	30	773	57.1	10.4	4.1	6
1996	7.81	1240	24.4	303	467	31	801	58.3	10.3	3.9	6
1997	8.32	1280	24.5	314	503	33	850	59.2	10.2	3.8	6
1998	8.78	1317	24.4	321	529	34	884	59.8	10.1	3.7	6
1999	9.27	1381	24.1	333	554	35	922	60.1	9.9	3.6	6
2000	9.87	1478	25.3	374	590	39	1003	58.8	10.2	3.8	6
2001	10.08	1486	22.8	339	581	37	957	60.7	9.5	3.4	5.8
2002	10.47	1444	20.6	298	577	35	910	63.4	8.7	2.8	5.5
2003	11	1510	20.1	304	607	36	947	55.2	8.6	2.8	5.1
2004	11.73	1647	20.4	336	652	39	1027	55.6	8.8	2.9	5.6
2005	12.49	1763	22.3	393	744	46	1183	59.6	9.5	3.1	6.0
2006	13.18	1857	24	446	809	50	1305	61.4	9.9	3.4	6.1
2008	14.17	1975	21.3	420	872	52	1344	61.5	9.4	3.0	6.2

Source: CSCMP's 12th, 17th, 18th, and 20th Annual State of Logistics Report

Apprendix 2. Rejuvenating Program for Logistics Industry

Source: Abstract from LI & FUNG (2009) which is the translation of the document from the State Council and the National Development and Reform Commission (NDRC) (2009).

1. Development goals

The government has set five development goals for the industry in the coming three years till 2011:

(1) To nurture a quantity of large logistics enterprises, which are internationally competitive, to provide integrated services

(2) To establish a modern logistics service system, which is of high technology, convenient, efficient, environmental friendly, safe and internationally competitive, to provide logistics service with higher quality

(3) To promote division of labor and increase the share of third party logistics (3PL) of China's logistics market

(4) To increase the scale of the logistics industry and the value-added of the industry by 10% or more annually

(5) To improve operational efficiency of the logistics industry and reduce the ratio of total logistics cost to GDP

2. Missions

The Program has outlined ten major missions for the logistics industry:

(1) Promoting application of modern logistics management and boosting demand for logistics service

The government will encourage integration of sourcing, production, retail and recycling logistics with the help of application of modern logistics management and technology. The government will also generate the demand for logistics service by promoting development of modern business operations or models such as franchise operation and e-commerce.

(2) Advocating division of labor and outsourcing of logistics functions and promoting intermodal transportation

Enterprises specialized in manufacturing and trading are encouraged to focus on their core competences and outsource non-core functions such as logistics in order to enhance their competitiveness. Therefore it is expected that development of 3PL will be accelerated. The government also hopes to enhance connections among different modes of transport so as to promote intermodal transportation.

(3) Encouraging consolidation of logistics industry

Facing the challenging environment of the logistics industry, the government wishes to nurture a quantity of large and internationally competitive logistics enterprises by encouraging industry consolidation by means of asset restructuring in the form of such as equity participation and holding, mergers and acquisitions (M&As) and collaboration.

(4) Boosting the development of logistics facilities and systems for strategic areas

The government will improve logistics infrastructure and system for strategic areas such as mineral products, agricultural products, consumer goods, healthcare products, automobile products, postal service, express delivery and emergency logistics. In addition, development of green logistics such as energy saving in daily operations of logistics enterprises is also highly recommended.

(5) Accelerating the development of international logistics and bonded logistics

The government will improve intermodal transport infrastructure such as port facilities with linkages to road and railway transportation so as to boost development of international logistics. On the other hand, the government will develop a modern bonded logistics regulatory system to facilitate development of bonded logistics.

(6) Proposing a well-planned layout for development of logistics industry

The government will identify nine major regions for logistics development and construct ten major logistics passages and a number of junction logistics cities. Exhibits 27-29 and Map 1 give you more information on the nine major regions, ten major logistics passages and the junction logistics cities. The government will also seek to remove the administrative barriers to development of regional logistics.

(7) Improving the connection of various modes of transport to improve logistics performance

The government will strengthen the connections among different modes of transport so as to enhance efficiency of resource exploitation and logistics performance. The government will also seek to meet the demand for management services in logistics through consolidation of existing resources and enhancement of current service level.

(8) Enhancing informatization level of logistics industry

Logistics enterprises are encouraged to apply information technology to improve their level of management. Public information platform for specific industries such as aviation should be promoted. Regional public information platform facilitating information exchange among cities should be promoted as well. On the other hand, the government will create a public information platform involving different departments including commerce, finance, insurance, customs, transportation and etc. in order to help foster a batch of logistics information service enterprises.

(9) Perfecting the standardization of the logistics industry

The government will speed up the establishment and promotion of sets of standards for various aspects of logistics industry such as logistics measurement, freight classification, operation procedures and etc.

(10) Promoting development and application of advanced technology for the logistics industry

Coding systems should be improved with the help of advanced technologies such as bar codes and Radio Frequency Identification (RFID). Latest technologies of transportation such as Geographical Information System (GIS), Vehicle Information and Communication System (VICS) and Electronic Toll Collection (ETC) should also be promoted. The government will

promote research and development (R&D) and manufacturing of logistics and transportation equipment and encourage enterprises to adopt advanced professional logistics equipment.

3. Key Initiatives

Nine key initiatives have been identified in *the Program*:

(1) Multimodal transportation

The government will identify a number of key transportation hubs and connect different modes of transport. It is hoped that the efficiency of transportation could be improved by promoting the development of seamless intermodal transportation.

(2) Logistics parks

A batch of multi-functional and efficient logistics parks will be constructed. The government will make sure the projects will be carried out in a coordinated manner to avoid duplicative construction and over-competition for resources.

(3) Urban distribution

The government encourages enterprises to apply modern logistics management and improve logistics efficiency in order to boost consumption. The government also urges the enterprises to improve the urban distribution network and strengthen the professional level of the distribution services.

(4) Bulk commodities and rural logistics

The government will accelerate the construction of logistics facilities for commodities such as coal, crude oil, mineral ores and food. On the other hand, more attention will be paid to rural logistics. Examples include development of fresh food wholesale markets, cold chain logistics facilities and logistics distribution centre for agricultural products in rural areas.

(5) Cooperation of manufacturing sector and logistics industry

The government will push manufacturing enterprises to outsource their non-core logistics functions to enhance their core competence. The government will nurture a group of 3PL enterprises to serve these manufacturing enterprises by improving their competence and promoting their service level. Pilot cooperation projects will be implemented in the near future.

(6) Logistics standards and technology promotion

The government will encourage enterprises to use standardized logistics facilities and equipment. The government will also push the enterprises to adopt advanced logistics technology such as RFID to promote their level of management. Pilot projects will be implemented in selected logistics parks.

(7) Logistics public information platforms

The government will facilitate the development of industries related to information sharing. The government will also speed up the development of regional logistics public information platform. Enterprises are encouraged to share their information and outsource such operations. This will help develop a logistics public information platform for SMEs.

(8) R&D of logistics technology

The government gives full support to R&D for new logistics technologies since this could stimulate innovation of logistics technology. As for the logistics equipment, R&D for modernized equipment is also encouraged to promote the modernization level of the industry.

(9) Emergency logistics

The government will establish an information system for contingency production, distribution, transportation and logistics enterprises so that the government could mobilize them during emergencies. An inter-departmental system will also be set up within the government for emergencies. Emergency logistics facilities and equipment should be enhanced to increase the capacity to manage emergencies. The government will also identify and foster a number of enterprises with the capacity to manage emergencies and involve them in establishing the emergency logistics system.

4. Supporting measures

To support the implementation of the above missions and initiatives, the following measures will be taken:

(1) Strengthening organization and coordination among departments and local governments

The central government will strengthen the organization and coordination among different departments and study the issues concerning development of modern logistics. Local governments will develop mechanisms for coordination as well as reviewing concerns about development of modern logistics.

(2) Accelerating institutional reform

The government will seek to accelerate institutional reform so as to promote the level of government services and functions. The government will put more efforts in avoiding local protectionism by removing administrative barriers set by different regions. More attention will also be paid to the monitoring and management of quality and safety of logistics industry.

(3) Strengthening policies and regulations related to the logistics industry

The government will review the implementation and efficiency of the existing policies and regulations related to logistics industry and will formulate new policies and regulations to facilitate further development of the industry. Logistics enterprises are urged to apply innovative management approaches and improve corporate governance. Enterprises are also encouraged to strengthen themselves by M&As.

(4) Boosting development of strategic products logistics and regional logistics

Relevant departments will push the logistics development of strategic products such as coal and food. For instance, NDRC will carry out specific studies on coal, food, cold chain logistics and etc. with other departments. The MOFCOM will work on studies related to logistics in the areas of commerce and trading. Local governments will formulate their plans for regional logistics development as well.

(5) Providing financial support to logistics infrastructure projects

Fund raising for the logistics infrastructure projects could be achieved in various forms including bank loans, listing in stock markets, bonds issuing, M&As and etc. As for those key national or

regional projects, aids from central and local governments will be provided in forms of direct investment or loan interest subsidies.

(6) Perfecting data and statistics system for the logistics industry

Scientific collection and analysis of data of the logistic industry will be the prime goal. Industry associations and organizations are encouraged to play an active role in achieving the goal. It is hoped that accurate and timely data and statistics will facilitate information exchange as well as establishment of a sharing platform for the industry.

(7) Continuing opening up of the industry and encouraging international cooperation

The government will promote trade in transport-related sectors with different countries and regions via platforms of World Trade Organization (WTO), free trade areas and other regional trade cooperation mechanisms. More efforts will be made to strengthening cooperation in logistics with Japan, South Korea, ASEAN countries and Central Asian countries. Exchange with foreign logistics enterprises will help improve the "soft" environment (e.g. management skills and knowledge on international rules) of China's logistics industry. The government will also establish a mechanism to protect the industry and will improve the mechanism for approving M&A deals involving foreign enterprises.

(8) Stepping up efforts in manpower training for the industry

The government seeks to speed up nurturing more logistics talents for the further development of the industry. Surveys and forecasts of demand for logistics talents will be strengthened while clear objectives and plans for formal education and vocational training will be formulated. The government will encourage cooperation among logistics enterprises, universities and research institutions in the planning of education of logistics talents. Vocational training in logistics will also be strengthened by developing relevant training programs and accreditation of relevant qualifications. Cooperation with international educational and training organizations will be highly supported.

(9) Enhancing the role of industry associations and organizations

Logistics industry associations and organizations are expected to bridge the communication between government and enterprises. They should play a more active role in formulating policies, developing code of practice, data collection and information sharing, manpower training and etc. for the industry.

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